



**BIOGRAPHICAL MEMOIRS OF FELLOWS OF  
THE INDIAN NATIONAL SCIENCE ACADEMY**

**Volume 15**



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**INDIAN NATIONAL SCIENCE ACADEMY  
NEW DELHI**

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## PREFACE

Over the years the Academy has endeavoured to bring out the biographies of some of its distinguished Fellows, written by those who were closely associated with them. This volume is the fifteenth in the series of these Biographical Memoirs. Amongst sixteen Fellows whose lives and works have been described in this volume, there are four Foundation Members; Professor Birbal Sahni, Professor P K Kichlu, Sir Charles G Trevor Kt and Dr K G Naik. Their contributions cover different disciplines of Physical, Chemical, Mathematical, Biological and Earth Sciences. Though they are no more with us but the foot-prints left behind by them have continued to inspire the successive generations.

Professor Birbal Sahni made notable contributions in the field of Palaeobotany. He was the founder Director of Birbal Sahni Institute of Palaeobotany, Lucknow. The Nation celebrated his Birth Centenary on 14 November, 1991. Professor P K Kichlu distinguished himself by his researches on Applied Optics and Experimental Physics.

Sir C G Trevor Kt and Shri J P Mills came to India with the missionary zeal to explore the forest and anthropological resources of the sub-continent respectively in which fields they made pioneering contributions.

Dr K G Naik, Professor P B Sarkar, Professor N A Yajnik devoted themselves to different branches of Chemistry, Dr K G Naik is remembered for his work on Reactive Methylene Group, for which he was elected a Fellow of Royal Institute of Chemistry (London). Professor P B Sarkar distinguished himself in the field of "Jute Lignin". Binary Mixtures, Magnetochemistry, Photochemistry, Radio Chemistry, Analytical Chemistry and Natural Products were the major fields of interest of Professor N A Yajnik.

Shri V V Sohoni was an eminent scholar of Meteorology. He was a pioneer in nor'westers and introduced the publication of the Weather Maps in the Indian dailies. Professor U S Nair devoted his study to statistics. He contributed to the basic theory of sampling distributions of Test Statistics. Professor B M Sen made significant contributions to Differential Geometry and Hydrodynamics. Dr N K Bose specialised in the fields of Aerodynamics, Hydraulics and Design of Structures built on permeable foundation.

Dr S B Setna was responsible for laying a strong foundation for work on marine fisheries in Western India. Professor S Ramanujam distinguished himself by his

researches in the fields of molecular genetics and plant breeding. Dr A C Joshi produced an encyclopaedic work on the Flora of Lahore which is still consulted by the students. He was keenly interested in the study of educational problems of the country. Dr S Parthasarathy devoted himself to the classical Scattering of Light, Raman Effect, X-ray Diffraction, Physics of Corrosion and Ultrasonics. Lt. Col. Jaswant Singh devoted himself to Malaria Control Programme of India.

I am thankful to the contributors of these memoirs. I also record my sincere thanks to the Editors of Publications Professors B L S Prakasa Rao and T J Pandian and the Staff of the Publication Division specially Dr M Dhara and Shri B P Bahuguna for bringing out this prestigious publication of the Academy.

*Sripanchami*  
8 February 1992

P N Tandon  
*President, INSA*

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Hibatullah

# BIRBAL SAHNI

(1891-1949)

Foundation Fellow

## BIRTH, PARENTAGE, CHILDHOOD

BIRBAL was born on the 14th November, 1891 at Bhera, Shahpur District. He was the third child of Lala Ruchi Ram Sahni and Srimati Ishwar Devi. Before Bhera became the ancestral home of the Sahnis, their ancestors migrated from Dehra Ismail Khan. The family finally migrated to Lahore early in the century. Ruchi Ram Sahni was Professor of Chemistry at the Government College, Lahore. A self-made man he came up the hard way in life, educating himself solely by scholarships he won at every stage of his educational career. An educationist with progressive ideas, Ruchi Ram became one of the leaders of the newly emerging *Brahmo Samaj* movement which believed in a casteless society. He was, in addition, a patriot who entered the national mainstream of the struggle for independence. It is this particular aspect of human endeavour that made a deep impression on young Birbal and, in later years, it will be seen how this burning sense of patriotism earned for Professor Sahni the respect and admiration of academic men and politicians alike. To derive this inspiration from contacts with leading political figures, at that point of time, in the twenties, not only Birbal, but also his brothers and sisters, were fortunate. They met patriots like Motilal Nehru, Gopalakrishna Gokhale, V.S. Srinivasa Sastry, Sarojini Naidu, Madan Mohan Malaviya and others, who were guests of Professor Ruchi Ram Sahni, at one time or another, in their Lahore home.

Memoirs of childhood days are not usually well documented. However, Birbal's younger brother, an eminent geologist Dr. M.R. Sahni, has given us through his 'Biography of Birbal Sahni' (*Everyday Science*) some fascinating accounts of young Birbal's spirit of adventure and love of Nature. His escapades in the hills near Murree in the company of his younger brothers and sisters, when they got lost in the ravines collecting crabs and his practical joke of cutting off root systems of standing vegetable crops when in a spirit of despondency, are given in great detail in the biography. All these make interesting reading as it underlines the spirit of delving deep into the problems of Nature and sparing no pains to understand the relationship of man *vis-a-vis* environment. Indeed, in later life, these early sensitivities could be discovered in Birbal Sahni's many writings and thoughtful discussions on problems of evolution. This passion for outdoor work by trekking in the Himalayas in quest of

plants, rocks and fossils, he actually acquired from his father and, in later life, this proved to be an asset in shaping his destiny as Birbal the Explorer.

### EDUCATION, DEGREES, FIELD OF SPECIALIZATION

Birbal received his early education in Lahore, first at the Mission and Central Model Schools and then at the Government College where his father held one of the Chairs in Chemistry. Among the many academic distinctions could be mentioned his standing first in Sanskrit at the matriculation examination of the Punjab University and a position in the Intermediate examination of the province. His flair and love for the Sanskrit language was of lasting value as he continued to keep his interest alive throughout his long academic career. Sahni graduated in 1911 from the Central College, Lahore obtaining the B.Sc. degree in Botany. The start was good as a personal association with a great Indian Botanist, Professor S.R. Kashyap, during those two years, was an unbreakable bond which was to continue for mutual benefit, in later years. The same year Birbal travelled to England and entered the portals of the Emmanuel College, University of Cambridge where he worked till 1919. In 1913 he obtained a First Class in Part I of the Natural Sciences Tripos and was soon after elected to a Foundation Scholarship in his college. Later he was elected to a Research Studentship. In 1915 Birbal completed Part II of the Tripos and about the same time took the B.Sc. Degree of the University of London. The most important event that moulded the scientific career of Birbal took place the moment he came under the spell of Professor Sir Albert C. Seward. Having taken the Tripos, Birbal started his researches on living and fossil plants, a field in which Professor Seward had carved out a niche for himself. An ideal *Guru-Sishya* relationship was soon established and a steady research output seemed assured as Professor Seward was, we are told, a truly inspiring personality whose exuberance for his chosen field of palaeobotanical research knew no bounds.

Sahni's first research paper was published in 1915 in the *New Phytologist* entitled : 'On the presence of foreign pollen in the ovules of *Ginkgo biloba* and its significance in the study of fossil plants'. This work was the starting point of a series of original scientific papers from one who was destined to be a leader of botanical and palaeobotanical researches in India in the years that followed. After the first paper in 1915, four more appeared till 1919 culminating in the publication of the well-known 'Lawson's Text-Book of Botany' (which was a vade-mecum in many Indian universities), a joint publication with J.C. Willis. The year 1919 was a significant year as the University of London conferred on Birbal Sahni, the Degree of Doctor of Science for his contributions to the study of fossil plants. In particular, Sahni's studies on the rare conifer *Acmopyle Pancheri*, the thought-provoking review of the morphology of evuliferous structures in conifers and his introduction of the terms 'stachysperms' and 'phyllosperms' seem to have given him the D.Sc. Degree.

The text of the thesis was published in the *Philosophical Transactions*, B, in 1920. At once this publication made Sahni emerge as an original thinker. The year 1919 was also significant in another context. Sahni returned to India as he had a tryst with destiny, so to say, for a leading role in giving a boost to Indian Science, particularly in the teaching of Botany and researches in Palaeobotany.

After a brief period of work at Munich under the well known morphologist Goebel, Sahni returned to India in 1919. For one year Professor Sahni held the Chair of Botany at the Banaras Hindu University and for one more year at the Punjab University from where he originally graduated in 1911. In 1921 Professor Sahni was appointed Professor of Botany at the University of Lucknow which post he held for nearly three decades with unique distinction. In fact, Professor Sahni's professional career can, for all purposes, be taken to start with his occupying the Lucknow Chair. The country's big school in Botany and Palaeobotany was born and made history in the years that followed, not only as a centre of excellence, but also as the harbinger of India's prestigious and unique Institute for Palaeobotanical Studies which bears the name of its illustrious founder Birbal Sahni. Lucknow University Botany Department became a place of pilgrimage—a 'Badrinath' for Botanists.

### PROFESSIONAL CAREER, POSITIONS

The main thrust in Professor Sahni's remarkable career at the Lucknow University was on teaching and research. He believed that to be a good teacher one has to be a good researcher, a maxim that could hardly be disputed by any one occupying a Chair in a university. With an unusual drive he revised the B.Sc. course in Botany and organized the postgraduate classes and, in 1923 the first batch of students appeared for the Final M.Sc. examination in Botany. Professor Sahni believed in small numbers at the M.Sc. and for many years he would admit not more than six students. He considered, however, that four students would be an optimum number, a situation vastly changed in today's concept of higher education. Professor Sahni taught all disciplines of the science at the B.Sc. level but confined himself to the groups of Pteridophytes, Gymnosperms, Morphology of Angiosperms and Genetics at the M.Sc. The years 1924-27 seemed to be crucial years as the department grew in size, staff strength and equipment. He was alive to the problem of diversifying teaching by inducting highly qualified teachers who had specialized in disciplines other than his. This process went on in the succeeding years. It is of interest to note that Professor Sahni's philosophy in teaching was that the junior classes should be handled by the seniormost teachers also. This ensured better discipline, balanced teaching and above all provided inspiration to the young students. Not only would Professor Sahni give lectures to the B.Sc. students but would also share the load of the practicals. He would always stress on the importance of well-conducted practical classes

as it is there that the learning process would be complete and the young student would understand the significance of the theoretical facts that were taught in the lectures. Seeing is believing and doubts get cleared. It is here that one would like to comment and say that Professor Sahni was considered by all his students as an outstanding teacher who spared no pains to impart the very latest views on any subject he handled. His was a life of total dedication.

At the Master's level his lectures would be very comprehensive discussing controversial theories clearly giving the pros and cons and leaving it to the intelligence of the student to form his own views. Apart from a profound knowledge of the subject he was handling, his lectures were a delight as he would illustrate them as he went along, with excellent sketches on the black-board drawn dexterously with both hands as rapidly as he covered the theoretical aspects. More importantly, what impressed his students most was his lucid style in chaste English with perfect accent and an unfaltering delivery. Indeed, he was an ideal Professor who inspired generations of young botanists throughout his long teaching career at the University. His concern for his students knew no bounds.

Busy as he was during the first ten years after taking over the Professorship at Lucknow in organizing teaching and research, he did accept the unanimous election to the post of Dean of the Faculty of Science in 1933, knowing full well that it meant an additional strain on his physical and mental resources. Nevertheless, he not only held this position with distinction till his death in 1949 but also did not allow this administrative post to make any inroads into his teaching and research time. A person of strong determination and impartiality in decision-making, he maintained perfect discipline in all the Science Departments of the University. When it came to a question of taking disciplinary action on erring students, he would not spare them, ignoring any interference for leniency from either his colleagues, or dignitaries from the public—a situation, alas, that has gone awry in our temples of learning today where indiscipline has become the rule.

### CONTRIBUTIONS TO NEW KNOWLEDGE

Professor Sahni's first interest in the rich fossil plants of India was in 1917 when he, in collaboration with his Guru Professor Seward, brought out a 'Revision of Indian Gondwana Plants' subsequently published in 1920 (*Mem. Geol. Surv. India, Pal. Indica 7, 1-40*). Much of this work dealt with gymnosperms of varied types and contained valuable information on the cuticular structure of plants of this age. This was perhaps the starting point of his determination to devote much of his time by critically examining the large accumulated collection of fossil plants in the Geological Survey of India. Sahni pursued this objective with gusto and brought out four noteworthy papers as contributions to the *Palaeontologica Indica*, published

in 1928 as part of *Memoirs of the Geological Survey of India*. Two of these papers dealt with a revision of the Indian fossil conifers. Over sixty forms of the conifers, many of them new to Science, were described. The most interesting were cones resembling those of the Abietineae, but differing from all living structures in this group. These fossils came from the Tertiary deposits of the Deccan and formed the basis of a new genus *Indostrobus*. In 1932 (also in *Palaeontologica Indica*) Sahni gave an account of a Bennettitalean plant *Williamsoria Sewardiana* and, in the same year, he described a new type of petrified wood of Jurassic age, *Homoxylon* which showed close resemblance to the wood of a living homoxylous angiosperm. Along-side with his interest in the fossil collections at the Geological Survey of India at Calcutta, he and his research students made extensive field collections and discovered many new fossiliferous localities in the country. A find of great importance was a well preserved leaf of *Glossopteris angustifolia* Br. of Lower Gondwana age which gave good cuticular preparations. This account was published in 1923. The highlight of this investigation was the evidence that *Glossopteris* was probably a seed bearing plant and not a fern. This period 1921 to 1929 was very important as it gave a big boost to the palaeobotanical researches at Lucknow. It was in 1929 that the university of Cambridge awarded the Sc.D. Degree to Professor Sahni in recognition of his leadership in palaeobotanical researches. This period and the decade that followed turned out to be equally important. A new type of gymnospermous plant of Jurassic age named Pentoxylycae was described and was reported at the meetings of the Empire Scientific Conference of the Royal Society in 1946 and a preliminary account was published subsequently in 1948 (*Bot Gaz.* 110, 47-80). These materials came from Nipania in Bihar and consisted of stems, leaves and ovulate cones. Although originally described as three separate organ genera, fresh evidence suggested that they all came from plants of one type. The stems had a remarkable structure with details in the secondary wood generally associated with conifers. The vascular structure of the petioles was similar to that of the recent cycads, while their stomata had characters akin to that of the Bennettitales. There were many other morphological details which needed further study. Professor H. Hamshaw Thomas in his Obituary Notices of Fellows of the Royal Society (Vol. 7, Nov. 1950) says this: "While further research on these structures is needed, especially directed to the discovery of the pollen-bearing parts, it is clear that Sahni has unearthed a completely new group of organisms of very great morphological interest".

During the period 1940 to 1949 other novel types of plant structures from the Rajmahal Hills named Ontheanthus and Ontheostrobus were described. Of equal importance was the great volume of work reported by Sahni and his group on the flora of the Intertrappean beds of the Deccan. The age of these plants was thought to be cretaceous by earlier workers but after critically studying new forms collected by the group, Sahni assigned them to Early Tertiary, possibly an Eocene age. From a study of the Deccan Intertrappean flora consisting of palm stems, fruits and flowers,

several cryptogamic remains, exactly like modern genera, all confirmed Sahni's claim of an Eocene age. A full description of *Azolla intertrappea* was published in 1941 showing the megaspores and groups of microspores of this earliest known species were essentially similar to those of the living forms. Later, more spores of this genus were described which resembled those of the living genus *Regnellidium*. From the same Deccan rocks, petrified remains of dicotyledonous plants were found. An account of a petrified fruit named *Enigmocarpon Parijai* was described by Sahni in 1943.

Professor Sahni initiated a new line of work on the study of microfossils and their use in stratigraphical geology. The spore content of the Permo-carboniferous rocks of India occupied his attention for nearly fifteen years towards the end of his scientific career. These researches, from a wide range of strata, particularly the microfossils in the beds of the saline series of the Salt Range was exciting. Fragments of plants and insects appeared to be not older than Tertiary although geologists had earlier considered the rocks to be of Cambrian age. It was the firm belief of Professor Sahni that fossil evidence was more dependable than evidence from mapping the beds in the field.

Just before his death Professor Sahni was engaged in a study of some Devonian plant remains from Spiti. He also studied some of the Palaeozoic tree-ferns like *Tubicaulis*, *Ankyropteris*, *Psaronius* and Deccan Intertrappean fossils like *Cyclanthodendron Sahni*, *Sausarospermum Fermori* and species of *Nipadites*.

The above account is only indicative of a cross-section of the highlights of the research output of a very fertile mind. Apart from his researches, Professor Sahni's major contribution to the Academic community was the building up of a very active school of research. His students continued to work with the same zeal and commitment to the growth of the science of Palaeobotany as their teacher did during his limited span of three decades. Between 1933-49 sixteen students had taken their doctorates, five of them a D.Sc. Professor Sahni was a hard worker and expected the same from his collaborators. He often used to remark : "Hard work killed nobody". His was a rare combination of an indefatigable worker with an intuitive and creative mind.

#### **MEMBERSHIP OF LEARNED BODIES, AWARDS, PRIZES**

Professor Sahni was a founder member, later President of the Indian Botanical Society and served also for many years on the Editorial Board of the Society's *J. Indian Botanical Society*. He was twice President of the National Academy of Sciences, Allahabad. Professor Sahni was a Fellow and Vice-President of the Indian Academy of Sciences and the National Institute of Sciences of India (now Indian National Science Academy, New Delhi). He was a fellow of the Asiatic Society of

Bengal, a member of the Court of the Indian Institute of Science, Bangalore, member of the Committee for Measurement of Geological Time and member of the Scientific Consultation Committee of the Government of India. In his long association with the Indian Science Congress, he was its General President in 1940 and presided over the Botany Section twice and the Geology section once. Professor Sahni represented India at the Scientific Conference convened by The Royal Society in 1945.

Professor Sahni was the recipient of the Barclay Medal of the Royal Asiatic Society of Bengal in 1936, the Nelson Wright Medal of the Numismatic Society of India in 1945 and the Sir C.R. Reddy National Prize in 1947. The Universities of Allahabad and Patna had conferred on him the Degree of Doctor of Science (*Honoris Causa*).

International recognition for his work came early in life. The University of Cambridge awarded the Sc.D. in 1929. He was the Vice-President of the Palaeobotany Sections of the Fifth and Sixth International Botanical Congresses in 1930 and 1935 held at Cambridge and Amsterdam respectively. In 1936 Professor Sahni was elected a Fellow of the Royal Society of London. He was a Fellow of the Geological Society of Great Britain and served on the Editorial Board of the international botanical journal *Chronica Botanica*. In 1947-48 Professor Sahni was elected a Corresponding Member of the Botanical Society of America, an Honorary Foreign Member of the American Academy of Arts and Sciences and as one of the Vice-Presidents of the International Palaeontological Union. He was elected an Honorary President of the International Botanical Congress held at Stockholm in 1950 but his untimely death in 1949 deprived him of being physically present and accept this honour.

### REMINISCENCES, MARRIAGE AND PERSONAL LIFE

Professor Sahni's stature in India and abroad was largely due to his professional knowledge of the subject, warmth of friendship and unfailing courtesy. To his students he was an ideal to be emulated, he was loved and respected. A nationalist to the core, his personality was one that attracted attention of the entire scientific community. He never sought anything from anyone. In fact, he was sought after for his wise Counsel both by Administrators and Academics. A man of taste, everything about him was spick and span; his attire was simple and elegant, a flowing 'Achkan', 'Churidars' and a Gandhi Cap, all from handspun, handwoven khadi. All this added to his charm. Even after forty years of his passing away, we, the students of this enchanting *Guru* have nothing but fond memories of the many years we were privileged to spend with such a one. His philosophy of life was one of attached detachment like a true Vedantin, for, that is what he was in his outlook. Duty was his main forte.

In 1920, Birbal Sahni married Savitri Suri, youngest daughter of Shri Sundar Das Suri, Inspector of Schools, Punjab. His marriage was a very happy one for Srimati Sahni took an active interest in his work and was a constant companion. With Professor Sahni's artistic and aesthetic bent of mind they built a beautiful home on the banks of the river Gomti in Lucknow where the Sahnis received and entertained numerous guests from India and abroad with utmost cordiality. Their hospitality was proverbial. The Sahni's had no children but that was amply compensated by their dedication to the subject of Palaeobotany and their burning desire to have a national institute for furthering researches in the subject. This work was fulfilled but under sad circumstances. However, one must say that, in the launching and nurturing of the Institute of Palaeobotany, Srimati Savitri Sahni had a major role to play as we shall currently see. Undaunted by the sudden passing away of Professor Sahni hardly a week after the foundation stone of the institute was laid, she picked up courage with both hands and gave every ounce of her energy in building up the fledgeling institute.

#### THE GREAT REWARD—THE BIRBAL SAHNI INSTITUTE OF PALAEOBOTANY

In September 1939, a Committee of Palaeobotanists, working in India, was formed with Professor Birbal Sahni as Convener. The first report "Palaeobotany in India" appeared in 1943. In 1946 an eight member committee signed a "Memorandum of Association" to found a Palaeobotanical Society which was Registered as a Trust and Professor and Srimati Sahni bequeathed private funds, immovable property, a reference library and a large fossil collection. In September 1948, the Government of Uttar Pradesh gifted an estate of 3.5 acres with a large building on the University Road, Lucknow. The foundation stone of the building of the projected Institute of Palaeobotany was laid by Independent India's first Prime Minister Pandit Jawaharlal Nehru on April 3, 1949. Within a week its Founder Director Professor Birbal Sahni passed away, a tragic happening for the project and the tasks ahead. The Governing Body of the Palaeobotanical Society was quick in authorising Srimati Savitri Sahni to discharge all duties of the Director of the new-born institute as well as looking after of the duties of the President of the Palaeobotanical Society. Smt. Sahni with her many-sided administrative abilities steered the affairs of the Institute in its formative years from 1949 to 1969. The Institute owes much to her dedicated service.

Professor Sahni's last speech on April 3, 1949 was a memorable one, and no one suspected that it was to be a swan song. Professor Sahni in requesting Pandit Nehru to lay the foundation stone said : "*It is our hope that in this stone a link will have been forged in the chain of international goodwill and cultural co-operation. By laying this foundation-stone you will, therefore, be helping us to achieve, for this young institute, a hopeful future of a broad and truly international outlook which is one of our main objectives.*

*For what is it, after all, that pious men worship in a stone which they place in a temple, but an idea, or an ideal, a great truth, a hope or a wish for a higher existence, whether in this world or in the next? And what is it that this stone symbolizes?—the great fact of the antiquity of plant life on the globe, the intellect of man ever striving to bring that fact more and more clearly to light, revealing different stages not only in the evolution of the plant kingdom in a more and more orderly and understandable sequence but also the evolution of his own poor understanding of these truths. The very construction of it, the flaws and imperfections in its entire make up, the labour that has gone into its preparation, are all but symbols of our imperfect and helpless efforts at constructing something new, something worthwhile.*

*Sir, may this foundation-stone, laid by your august hands, prove worthy of you and augur for the science of Palaeobotany and this institute an ever-brighter and more useful future in which men of all nations will cooperate in the spirit of science and of service”.*

Speaking on the occasion Pandit Jawaharlal Nehru said : “*I used to attend Professor Seward’s lectures in Botany and I also learnt some Geology at Cambridge. This is one of the reasons for my interest in today’s proceedings. But the real cause for my interest is that Professor Sahni symbolizes in him the kind of scientist that every scientist should be. He has devoted his life with all the energy at his command to his research and most assuredly he will continue to do so. This quality in a man concerning his work exercises a tremendous influence on others. A man who pursues his work in such a devoted manner follows the right path, his work is good, the man is good. Many of the problems of the country could be easily solved if the people had the single-minded devotion to duty that marks Dr. Sahni.....There is need for reconciling and adjusting one’s mind to the changing times and thinking in a scientific manner. Science alone can help us to understand our problems, for science means seeking the truth. I am, therefore, happy to lay the foundation-stone of this institute which will help the people to take interest in science and create in them a consciousness about science”.*

It was not till the end of 1952 major part of the main building of the Institute was ready for the opening function by none other than Prime Minister Jawaharlal Nehru who had laid the foundation-stone in 1949. Pandit Nehru observed : “*The progress in scientific knowledge of any country opens the minds of its people and this is the advantage that counts in the ultimate analysis. A big country has many advantages and disadvantages. A disadvantage is that being self-sufficient, its people become introvert and do not like to learn from the people of other countries. This closes their minds and ultimately, they become narrow minded. This is the most harmful attitude that any nation can develop.*

*The very fact that a large number of scientists have come from foreign countries specially to attend this function shows the regard in which Dr. Sahni is held in the*

*scientific world. It is a misfortune that he died just after starting this Institute and in an early age. I was impressed by Dr. Sahni's sincerity. I was attracted by the proposal put by Dr. Sahni for building a research Institute of Palaeobotany partly because of his interest in the subject that he had developed during his stay at Cambridge, but mainly due to his personality. He was a balanced man, a man of even temper like every great scientist. Such men are always few.*

*I feel immensely happy when I see young boys and girls doing good work in these research institutes and laboratories because I feel that they are laying the foundation of our progress.*

It was, perhaps, not so fortuitous that Prime Minister Nehru laid the foundation-stone in 1949 and later opened the Institute in 1952. Pandit Jawaharlal Nehru and Birbal Sahni had, indeed, some common denominators which brought them together. Both were born on a 14th November. Both went to the Cambridge University and were contemporaries; both took a Tripos with Botany and Geology; both listened to the lectures of the eminent botanist Professor Sir A.C. Seward; both later in life were rationalists, nationalists and internationalists; both became thinkers, writers and researchers; both were clad in khadi; finally, one became a leader of a nation and a great World Statesman, while the other became a leader among men of Science and an outstanding educationist.

With such a colourful launching of the Institute its future seemed assured. Well funded by the Department of Science and Technology of the Government of India, and well staffed, the Birbal Sahni Institute is now one of our premier national laboratories which can be said to be a fitting memory to a great teacher, researcher and servant whose name it proudly bears.

In being asked to write this biographical sketch I feel privileged. It has given me an opportunity to offer 'Shradhanjali' (respectful and dedicated tribute) to my Guru. Forty years have rolled by since Professor Sahni passed away but, even then, to overcome the awe that stood between the teacher and taught, it needed some mental preparedness. At last this biographical sketch is before the readers.

It is prudent to sum up my feelings by quoting the Immortal Classic, Srimad Bhagawad Gita which brings out the 'Purnapurusha' (the complete man) in Professor Sahni. He still lives in our hearts.

न जायते ग्रियते वा कदाचि-

न्नार्थं भूत्वा भविता वा न भूयः ॥

अजो नित्यः शाश्वतोऽर्थं पुराणो

न हन्यते हन्यमाने शरीरे ॥२०॥

"The soul is never born nor dies; nor does it exist on coming into being. For it is unborn, eternal, everlasting and primeval; even though the body is slain, the soul is not".

T. S. SADASIVAN

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Z. Lohóni

## VISWANATHA VISHNU SOHONI

(1898-1977)

(Elected Fellow 1943)

### BIRTH, EARLY LIFE & EDUCATION

SHRI VISWANATHA VISHNU SOHONI was born on 6 September 1898 at the village of Agargulen in the Ratnagiri district of the Maharashtra State. After matriculating in 1914 from the local Government High School he joined the Wilson College, Bombay where he took his B.A. degree with First Class Honours in 1919. He was awarded a Fellowship and Demonstratorship in the College where he worked for a couple of years taking his B.Sc. degree in the first class in 1921. Shri Sohoni had a uniformly bright academic career being the recipient of merit scholarships and prizes both at school and in the college.

Shri Sohoni joined the India Meteorological Department (IMD) at Simla in March 1922 as a Class I Meteorologist, being one of the first four Indians to be selected to such a position in the Department which till then was manned by British scientists in the higher cadres. Quite early in his career he became conversant with the various technical activities of the Meteorological Department in those days which included Weather Forecasting, Storm Warning, Meteorological Instrumentation and Inspection of Observatories for standardisation of instruments and ensuring the quality of the observations recorded and reported by the stations.

### SERVICE & CAREER

In 1926 Shri Sohoni was posted to the Meteorological Office at Alipore, Calcutta as the first full-time Meteorologist in charge of storm warning work for the Bay of Bengal when this work was transferred from Simla to Calcutta. He did excellent work in this new position of responsibility and introduced a number of procedures to improve the efficiency of the storm warning service for shipping. His work at Calcutta won for him the praise and appreciation of the shipping interests.

At Calcutta Shri Sohoni carried out a comprehensive study of the pre-monsoon thunderstorms known as nor'westers. The results of this study were published by him in two papers in the *Scientific Notes* of the IMD. Later he made a study of the latent instability in the atmosphere as revealed by Indian tephigrams and published

the results as a *Memoir* of the IMD. His work on thunderstorms and atmospheric instability won for him the M.Sc. degree of the Bombay University. While working at Calcutta Shri Sohoni also did cataloguing of all the meteorological literature in the publications of the Asiatic Society of Bengal covering a period of over 100 years.

With the outbreak of World War II in 1939 the functional responsibilities of the India Meteorological Department increased, leading to the expansion of the Department and the creation of some senior posts of Superintending Meteorologists. Shri Sohoni was appointed to one of these positions. In the early years of the war, he worked at the Meteorological Office, Poona holding charge of several responsible positions—Administration, Weather Forecasting including Storm Warning for the Arabian Sea and the Statistical Division responsible for the issue of seasonal forecasts of monsoon and winter rainfall.

In 1942 Shri Sohoni organised a new Meteorological Office at Bangalore to cater to the war-time needs of the Royal Air Force unit operating from there. His work received praise from the local Air Command.

During the war period the Headquarters of the India Meteorological Department were shifted from Poona to New Delhi to maintain closer liaison with the Government. As a senior officer of the Department Shri Sohoni worked at Delhi till the end of World War II in charge of Administration. During this period he introduced a number of innovations to tone up the administrative efficiency of the Department and to minimise the element of subjectivity in selection and recruitment.

From 1946 to 1949 Shri Sohoni was Deputy Director General of Observatories in charge successively of the Climatological and Forecasting Organisations of the Department. During this period he visited Toronto, Montreal and Washington for attending International Meteorological Conferences of the post-war years.

Shri Sohoni succeeded Dr. S.K. Banerji as Director General of Observatories in 1950 and continued in that capacity till his retirement from service in 1953. As Head of the India Meteorological Department he was the permanent representative of India with the World Meteorological Organisation (WMO) which came into existence in 1950 as successor to the International Meteorological Organisation (IMO) of the pre-war years. He was elected President of the Regional Association for Asia (RA-II) of the WMO in April 1951 and continued to hold this position till his retirement. As President of the RA-II he was also ex-officio member of the Executive Committee of the WMO. In his capacity as the Director General of Observatories, Shri Sohoni was ex-officio Editor of the *Indian Journal of Meteorology and Geophysics* which was started by the IMD in 1950.

## HONOURS

Shri Sohoni was elected to the Fellowship of the Indian National Science Academy (then the National Institute of Sciences) in 1943. Apart from his work on thunderstorms and atmospheric instability referred to earlier, Shri Sohoni organised field experiments to study the influence of the electrification of Alibag town on the instrumental records of the local geomagnetic observatory. This study was undertaken around the 1950's because of the pressing demands from the local public for the electrification of Alibag town which could no longer be resisted. Hence it became necessary to ascertain by experimentation whether any restrictions had to be stipulated regarding the proximity of the over head electric lines to the Alibag Observatory—one of the oldest geomagnetic observatories of the world—to ensure that the records of the magnetometers are not vitiated.

Shri Sohoni took keen interest in popularising meteorology and making known to the public the practical benefits of meteorological science. For this purpose he organised the publication of Weather Maps in the daily newspapers in the country. He also contributed popular articles on scientific topics in English and in Marathi.

## PERSONALITY

Shri Sohoni was a person of sharp intellect, quick understanding and methodical habits. He had excellent mastery of the practical and service aspects of meteorology. Apart from his technical abilities he was also known as an able administrator with insight, comprehension and capacity for taking quick and correct decisions. His talks and writings were characterised by clarity and precision. He had a subtle sense of humour which enlivened his conversation. He was a good tennis player. He was fond of reading and was well informed on a variety of topics. Among his hobbies were stamp collection and photography. He had a large collection of stamps and an album of prize-winning photographs which he showed and explained to his close friends.

## LAST DAYS

After his retirement from service he settled down in Poona where he built a house with a large garden. He was fond of horticulture and reared a variety of plants and fruit trees in his garden with scientific care and attention.

Shri Sohoni passed away at Poona on 5 May 1977, survived by his wife, three daughters and one son.

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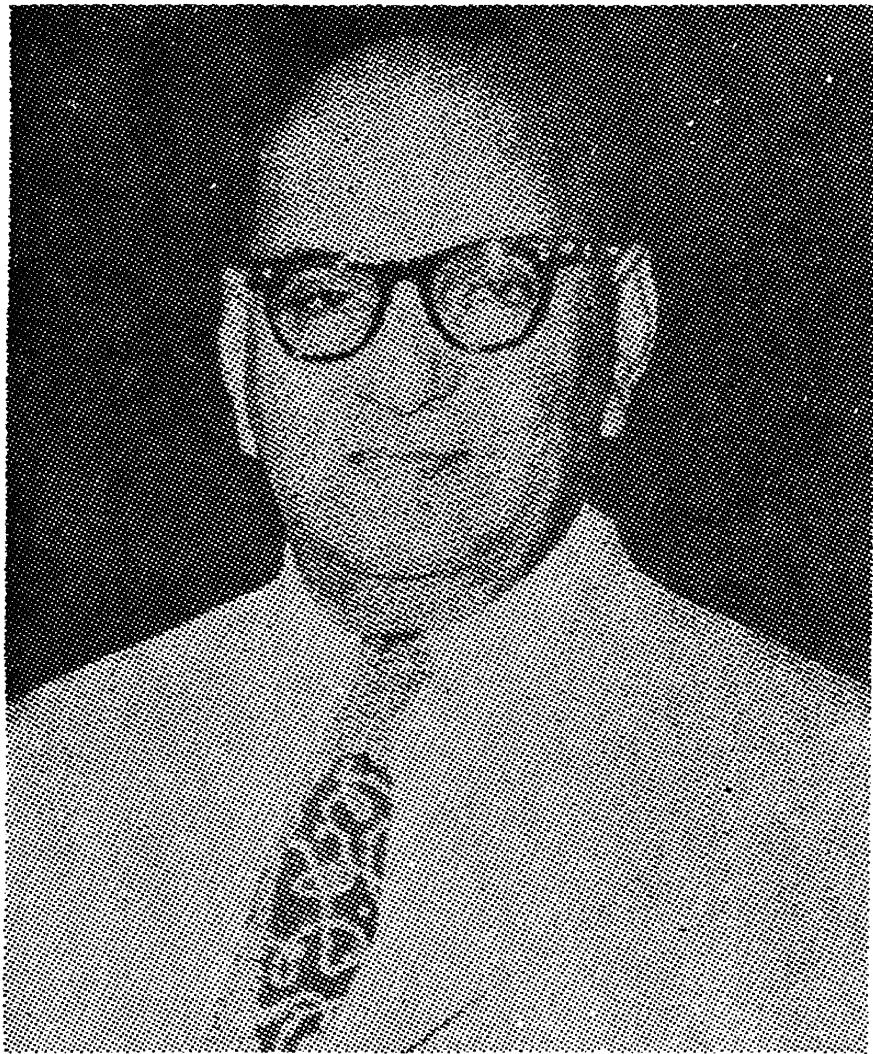
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## **SAM BOMANSHAH SETNA**

**(1895-1969)**

**Elected Fellow 1943**

### **EARLY LIFE AND EDUCATION**

**SAM BOMANSHAH SETNA** was indeed the pioneer in the field of development of marine fisheries in India. He was born in Lahore on June 1, 1895 in a well-to-do Parsi family. He completed his high school and college education in Lahore only and took his MSc degree in Zoology of the Punjab University, in 1922. Late Dr. Baini Prasad, the former Fisheries Development Adviser to Government of India and late Dr. S.L. Hora, retired Director of Fisheries, West Bengal were his senior colleagues in the college and in profession. After his post-graduate degree, Setna joined the then Royal Institute of Science, Bombay as a lecturer in Zoology but he soon left that institute for higher studies to join the Science College of Cambridge where he obtained his PhD in marine biology. At that institute he was fortunate to get the guidance of Professor Gardner and Professor Grey in his research work. During that period he studied the working of Marine Biological Research Stations at different places in UK and Western Europe. Apart from completing his course in marine biology, he worked in the Microbiological Section of which he later on became a fellow. It was during his study tours in Europe that he dreamt of an outstanding marine biological research station and an aquarium in India.

### **CONTRIBUTIONS TO FISHERIES RESEARCH**

After completing the studies in UK he returned to his teaching job. However, his observations on marine biological research stations as well as on fisheries establishments in Hull and Grimsby continued to attract him towards practical application of zoology, namely the fisheries in India. This urge for doing something concrete in fisheries made him accept a challenging job of Fisheries Officer in the Andaman & Nicobars during 1931-32 where foreign vessels were prowling around the islands and poached the marine wealth without the permission of the Government of India. He toured through the difficult localities of the islands and submitted a detailed report on the status of fisheries and the marine biological wealth around these islands including the well known Trochus. After that short assignment he returned to the Royal Institute of Science only to leave it and join the Department of Industries as a Fisheries Officer in November 1933. At that time the Government of the then Bombay

Presidency had ordered an enquiry into the possibility of development of fisheries of that presidency and an exhaustive report was submitted by Dr. H. T. Sorley, one of the ICS Officers in charge of Salt Department which controlled the fish curing yards at that time. The Government felt that some steps were necessary to ameliorate the socio-economic condition of the fishermen as well as to modernise the fisheries. Dr. Sorley had not recommended large expansion of this sector but on his suggestion a post of Fisheries Officer was created along with that of an Inspector of Fisheries for the fish curing yards. He had, nevertheless, recommended motorization of small fishing vessels only because the experimental trawling conducted aboard "the William Carrick" (a steam trawler) was not economically successful.

Dr. Setna after his appointment as Fisheries Officer, undertook a detailed study of the recommendations in the report as well as the actual conditions of the trade and the marketing problems. This took him very close to the fishermen of Bombay and the suburban districts to realise their poverty and helplessness of their livelihood. During one of his visits to inspect the fish curing yards in North Kanara (now in Karnataka) he observed abundant catches of mackerel in Karwar, Chendia, Bingi etc. He conducted inquiries into the possibilities of a market in Bombay for mackerel and the sardines which were then unknown to Bombay people. After studying this problem he chalked out a scheme to import this fish in ice and to introduce it into Bombay market. Local fishermen being poor could not afford this expensive project of constructing a transport launch and enter the new venture. The only method which he found feasible was to construct a couple of launches departmentally and pass them on to the fishermen on hire purchase basis. Luckily the Government saw good potential for development in his scheme and approved the system of operating the vessels under the direction of the Fisheries Officer. This was in late 1934. After a few trials the scheme turned out to be a great success and a number of entrepreneurs independently came forward to undertake the business. This marked the first phenomenal success in Dr. Setna's career. Such transport appears to be a simple matter at present but it was a big step forward in those days.

After a few years the World War II intervened, but he saw to it that the fish supply to Bombay was maintained without any reduction. Not only this, he organized with the help of his trained assistants, fish smoking kilns all along the coast in the fish curing yards of the department and arranged a regular supply of smoked fish to the army at different places. In addition to these Dr. Setna started other schemes such as the development of inland fisheries and the extraction of shark liver oil for medicinal purposes. Although the progress of development of inland fisheries was rather tardy because of lack of fishseed in local waters, the shark liver oil scheme made an effective impact on the cod liver oil trade. Firstly the shark liver oil which was rich in vitamin A met the urgent needs of the Defence personnel as well as the public and secondly it reduced pressure on foreign exchange by substituting for

the Norwegian Cod Liver Oil. In the early stages several experiments were undertaken to evolve simple methods for extraction of oil which could be adopted all along the coast. Later on, a regular shark-liver oil laboratory was established and the work systematized.

These activities indicated a need for a separate department so that different schemes could be undertaken more speedily and effectively. Luckily the government saw the wisdom behind this suggestion and constituted a separate department of fisheries in the year 1945. This gave considerable impetus to the enthusiasm of Dr. Setna for pursuing his imaginative proposals for the development of fisheries in an all-around manner. His immediate task was to pursue his favourite scheme for establishment of an aquarium and marine biological research station which he had envisaged as early as in 1938, with the help of Bombay Natural History Society. He approached the local government to finance it, but was told to find a donor for that purpose. Dr. Setna's persuasive approach did not take long to get a donor in late Shri Bhikaji D. B Taraporevala, a lover of books and natural history. But the impact of war had compelled Dr. Setna to put the scheme in cold storage. Nevertheless, he retrieved the same as soon as the war was over and approached the government with fresh proposals. Considerable difficulties had to be faced as regards suitable land and also the financial estimates which far exceeded the pre-war estimates. But persistent efforts and arguments by Dr. Setna enabled him to get government's approval and finally to inaugurate the aquarium in May 1951 at the hands of the then President of India, Dr. Rajendra Prasad. It was a consummation of his long-cherished dream and he worked incessantly to maintain the quality and standard of the aquarium which proudly continues to be his living memorial in Bombay, even to this date. Another important activity which can be called as his monumental contribution was the mechanisation of the local fishing craft. Initially, fishermen had natural fear that fish will be scared away by the noise of the engine. So, to begin with, a craft which was later named 'Tapase' was constructed for demonstration of fishing and to dispel the aforesaid fear. Later on it was found that the indigenous fishing vessels were well designed and strong enough to accommodate in-board engines with only slight modification. Thus, fishermen could follow their fishing methods with the advantages of a motorised vessel and reap a better harvest of the sea. This method spread very fast after Dr. Setna's return from USA where he was deputed to study modern methods of fisheries development under the TCM of US AID programme. Marine engines and other modern equipment offered under this programme provided a sturdy plank for implementation of Dr. Setna's schemes in different spheres. In this connection it can be stated that he was the first fishery official to entrust the fishermen's cooperative societies with the responsibilities of running ice and cold storage plants intended for their own vocation.

Concurrently with the aforesaid programme of small boat mechanisation, the Government of India undertook exploration of deep sea areas with the help of large

trawlers such as the 'S T Meena' 'Ashok', 'Pratap', 'Bumli' 'Champa' etc. While the fishing operations of these large vessels were not economically successful, the performance of small boats, for unit value of investment, was quite outstanding both for increased fish production and for financial benefits to the fishermen. The remarkable success attracted the attention of the National Institute of Sciences of India (now Indian National Science Academy) which honoured him in 1950 with the coveted Chandrakala Hora Gold Medal instituted by Dr. S. L. Hora, for excellence and all round development of fisheries in India. He retired as Director of fisheries in March 1954, on superannuation, when he was at the zenith of his career.

His post-retirement period marked another spell of outstanding achievements for which he turned his attention to the deeper or distant waters of the sea, with the help of large fishing vessels, the operation of which, as Director of Fisheries, he did not recommend for the ordinary fishermen. In the early stages of this period, he studied the performance of a Japanese trawler 'Tayo Maru 17' which operated on the Gujarat coast, on the invitation of Saurashtra Government. The analysis indicated possibilities of commercial success with large vessels and resulted in a collaboration with the world famous Tayo Fishing Company of Japan and with the help of the astute business acumen of Shri P.B. Advani the former Director of Industries, Dr. Setna succeeded in forging a joint venture under the name New India Fisheries Ltd. The company commenced fishing from Bombay using four 35 m trawlers, 'Paj', 'Harnai', 'Arnalla', and 'Satpati' named after four prominent fishing villages of Maharashtra. In the successful operation of these vessels was the real test of Dr. Setna's ability, but he acquitted himself very creditably in this ordeal. In previous years, similar efforts made on Kerala and Bombay coasts had failed miserably. Success of New India Fisheries can largely be attributed to two important factors, namely : (1) efficient fishing operations by the Japanese experts, and (2) excellent shore management by Dr. Setna. In this respect his towering efficiency can hardly be matched by anybody and deserves to be emulated by many. Every time his vessels returned to port, he moved heaven and earth to see that they left on their next trip within 24 hours, by keeping all loading and unloading arrangements ready to operate without any delay. Despite these pre-occupations at the fishing harbour, he supervised fish marketing operations at the wholesale fish market at 5.30 in the morning. The real key to all his success was his pragmatic planning and matchless hardwork. This exemplary work laid the primary foundation in India of distant water fishing aboard large vessels. Although he had some heart trouble and diabetes, he never rested on his oars and died fighting like a soldier on September 29, 1969, leaving a stamp of excellence on whatever he handled.

#### **ASSOCIATION WITH SCIENTIFIC ORGANIZATIONS**

He took keen interest in the activities of different scientific organizations of India. Since his time as lecturer in Zoology in the Institute of Science, he was a

member of the Indian Science Congress Association and was later elected as Fellow of the Indian National Science Academy. As a member on the Executive Committee of the Bombay Natural History Society, he guided its activities and also worked as Honorary Editor of its journal for some time. He was a Fellow of the Zoological Society of India also and was President of the Bombay Aquarium Society. Apart from the practical methods of fisheries development in small and medium sector which he ably demonstrated, he served on several fisheries committees of the Government of India including the ICAR and offered his expert advice without fear or favour.

### SETNA AS A PERSON

As a person he was always very jovial and light hearted and made excellent company whether amidst scientists, administrators or even uneducated fishermen. He was never daunted by any adverse situation and showed great sagacity in planning his steps. To his junior colleagues he was sometimes stern but considerate and exacted utmost efficiency. However, he did not forget to give them their dues whenever deserved. He instilled a sense of devotion and hardwork by his own sincerity and painstaking example, both in the field and in the office administration. To people of indifferent means he was generous true to Parsi tradition, but expected ungrudging honesty. On account of these capabilities, he proved himself indispensable in certain situations.

At his college in Lahore he was known for his forceful dash at forward position in hockey and football despite his own structural rotundity. He sometimes recalled the nutritious ration he and his colleagues got from the college for their performance in sports. He continued his sports activity even in UK and was a Cambridge blue. He carried forward that affinity for sports even when he joined Royal Institute of Science, Bombay and endeared himself to staff and students alike. The stamina he attained in his younger age through sports stood him in good stead till the last.

As regards scientific research, he was always very keen and provided facilities to those who required them. Whether concerned directly or indirectly, he always encouraged scientific investigations by all technical staff and considered that activity as a backbone of technical departments. He was extremely meticulous about language (English) whether it was for a scientific paper, an administrative report or for an ordinary letter. He published several scientific papers and articles on fish biology and fishing trade along with his colleagues.

### FAMILY LIFE

Even in his personal family sphere, he was a jovial husband and affectionate father; but in the latter capacity he did show his firmness where duty was involved. His wife came from a family of a wealthy cinema owner of Bombay and he owed his

business acumen partly to his father-in-law. His wife, Najamai who was an able companion died before his death. They left behind two well-educated daughters, the elder Sunnu, MD in Gynaecology and the younger, Roshan, BSc, an entrepreneur herself in fish processing industry. Both are happily married and well settled in life.

Dr Setna's personality was thus of an all round nature and deserved admiration of his colleagues, friends and even fellow fishermen all throughout India and even abroad. His exemplary sense of duty and devotion would always remain as fountain of inspiration and guide light to many who came in contact with him.

C. V. KULKARNI

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Liberation War

# **UNNI SIVARAMAN NAIR**

**(1904-1982)**

**Elected Fellow 1945**

## **BIOGRAPHY**

**UNNI SIVARAMAN NAIR** was the eighth of ten children born to Unni Nair of Chavakadu near Guruvayoor and Rugmini Amma of Trivandrum. He was born on the 22nd of January 1904 in Parur near Cochin where his father was looking after his interests in landholdings. Sivaraman Nair had his early schooling in Parur. As the family shifted to Trivandrum, his high school education was done in the Model School of Trivandrum city. He had his B.A. in Mathematics from the Maharaja's College, Trivandrum which was then affiliated to Madras University. All along his education Nair maintained high scholastic record. At that time there was no post-graduate course in Trivandrum. He studied for his M.A. by private and was the youngest to get M.A. at the age of 20. While in school the boy showed histrionic talents by participating in school dramas. He played the female roles in Shakespearian plays and historic malayalam novels.

After his masters, Nair got a teaching job in the Department of Mathematics of Maharaja's College. In 1927 he married Saraswathi Amma, daughter of Shri T. Palpu Pillai, then well known judge of the High Court. The couple were blessed with five children, four boys and one girl. The eldest son was Air Commodore in Poona when he met with a fatal plane accident. Two of the sons are engineers. The daughter is the wife of K.P.S. Menon (Junior) who was Indian Ambassador to Japan and now retired as Foreign Secretary to Government of India.

In 1936 Nair left for London for advanced studies. He worked under the guidance of Prof. E.S. Pearson at the University of London for his Ph.D. Programme. He returned from U.K. in 1939 after receiving a prestigious Ph.D. degree in Statistics, the first of its kind to be received by an Indian from a foreign university. On his return he joined as Assistant Professor of Mathematics in the Maharaja's College of Science, Trivandrum. Then began his relentless effort to bring to the notice of the university authorities and the administrators in the Travancore State Government and to convince them of the growing importance of Statistics and the necessity for introducing Statistics as a subject of study at the post-graduate level.

His persistent efforts bore fruit in 1944 when the Travancore University decided to set up a Post-graduate Department of Statistics under the University and appointed

Dr. Nair as the first Professor and Head of the Department. In 1945 the first batch of M.Sc. (Statistics) students were admitted in the department and the University of Travancore thus became the second University in India (the first being the Calcutta University) to introduce a regular two year M.Sc. course in Statistics.

It was with missionary zeal that Dr. Nair laid firm foundations and built a school of statisticians to teach and propagate statistics and to do research so that the benefits of this growing science were made available for the advancement of research and technology.

Two years prior to his retirement from University in 1959, Dr. Nair accepted visiting Professorship of University of California. Thereafter he was appointed as U.N. Statistical Adviser under the E.C.A.F.E. for about six years in two terms. The first term was spent in Bangkok and the second term was spent in British Honduras.

After his foreign assignment he returned to Trivandrum in 1964 to lead a peaceful quite life at "Jacinth" his home in the city. But his pursuit of knowledge and search for truth continued. This time in Upanishads. He was linking his knowledge of probability with Katopanishad.

His former students and admirers set up an organization named Kerala Statistical Institute in his honour and he was its chairman until his death.

He left for Japan in 1982 March with his wife to stay with their daughter. The end came very peacefully. He retired for the night on 8th August 1982. The curtain fell to that illustrious career at 7.00 P.M.

### RESEARCH WORK

His first paper appeared in 1936 in Biometrika which dealt with Gini's Mean Difference. He developed an ingenious method of finding the standard error of the sample Gini's mean difference for a given distribution. He discussed the efficiency of Gini's Mean Difference as an estimate of population scale parameter for normal, exponential and rectangular distribution, compared to other estimates in use namely sample standard deviation, range and mean deviation. He could establish that Gini's Mean Difference is a better estimate of  $\sigma$  in the case of normal population whereas it is less efficient than range and mean deviation in the case of exponential and rectangular distributions. The merit of this paper lies in his capacity to deduce simple meaningful results with the aid of sophisticated mathematical technique.

The first major work of Dr. Nair was his comprehensive study of the role of moment functions in distribution theory. Published in 1939 in Biometrika Vol. XXX, the paper discusses methods of deriving distribution laws for

functions of sample values using moment functions. It is to be noted that until that time there were only two known techniques for studying distribution functions namely characteristic functions and transformation of variables. Dr. Nair was able to find the sampling distributions of Neyman-Pearson  $L_1$  criterion in the case of K samples of equal size. Eventhough the distributions were in terms of complicated integrals, he was able to show how they can be conveniently used to calculate the levels of significance of the  $L_1$ -criterion. The paper also gave an elegant mathematical solution to Wilk's Type B integral equation. A detailed study of these functions from the mathematical point of view was made with the help of differential equations satisfied by them. This paper was widely acclaimed as a breakthrough in the basic theory of sampling distributions of Test Statistics.

His paper on Testing Hypothesis on the difference between variances in two samples appeared in *Sankhya* Vol. 5, 1941. This paper is devoted to developing unbiased tests. The paper also throws light on the form of the most appropriate criterion to use in testing for homogeneity in the case of more than two samples. His work on the estimation of confidence interval for the ratio of standard deviations and correlation coefficient in a bivariate normal population was published in *Sankhya* Vol. 5, Part II, 1941. A method was derived in this paper to test hypothesis regarding the ratio of standard deviations and the correlation coefficient in a bivariate normal population assuming one of the two was known.

Dr. Nair's contributions to Applied Statistics came in the form of Index of Approximations which was published in the *Bulletin of International Statistical Institute* Vol. XXXIII, Part II. This arose from his experience as superintendent of Census Operations, Travancore-Cochin 1951. The object of the study was to ascertain how closely sample count values did in fact approximate to total count values and compare the observed facts with results deducible from mathematical theory. He developed A as the index of approximation with the property that the population proportion lies between the limits  $\frac{p}{1 + A/200}$  and  $\frac{p}{1 - A/200}$  with probability  $1 - \frac{A}{100}$  where p is the sample proportion. This measure had great practical utility in surveys undertaken by the State.

Dr. Nair's Presidential Address at the Statistical Section of the Indian Science Congress at the Thirty Sixth Session at Allahabad, 1949 was a landmark in the Teaching Methodology of Statistics. It was he who first extensively used matrix method in class-room in multivariate statistical studies. At this session he had shown how the statistical theories could be elegantly written in terms of matrices. Professor C.R. Rao has recognised this aspect of Dr. Nair's contribution in his book on statistical methods for biometric research.

### AS ORGANISER OF STATISTICAL ACTIVITIES

*Census 1951* : The trust the government and people had on the organising ability of Dr. Nair could be seen from the fact that he was appointed as Superintendent of Census Operations in the former Travancore-Cochin State for the 1951 Census. He did an exemplary job in organising the activities as well as in reporting the analysis. The report were "crisp" and "factual" and received commendations from several quarters. Another honour that went to him in this connection was the authorization given to him to conduct a sample study for the entire nation on the basis of 1951 Census and it was at this time that he evolved a new formulae known as index of approximation.

*Government Statistician* : The association of Dr. Nair with the statistical activities at the government level started when he was put in complete charge of the "Scheme for Improvement of Agricultural Statistics" in 1949 implemented as a post-war reconstruction programme under the Department of Research of the former Travancore University. Under this scheme Travancore became one of the Pioneer states in India to introduce random sampling technique for the conduct of crop-cutting surveys on paddy during the summer (Punja) season 1950. In 1951, the State Government constituted the Board of Statistics with the Director of Research, University of Travancore as Chairman. Dr. U.S. Nair as Professor of Statistics served as a member of the Board to provide necessary guidance in all technical matters. The major items of work entrusted to the Board were the conduct of crop cutting surveys on paddy, land utilization surveys and collection of prices statistics and analysis of the data.

The Board of Statistics was reorganised as the Department of Statistics in 1954 which was the Central agency in the State for the systematic collection, compilation and analysis and objective interpretation of all Statistics relating to the State. The Head of the Department was designated as Director of Statistics who has been declared as statistical authority for the State under the various laws in force. Dr. Nair was the first Director of Statistics in the State in addition to his normal duties as Professor of Statistics in the University.

In 1954, the State participated in the National Sample Survey of the Indian Statistical Institute, Calcutta under the guidance of Dr. Nair. Dr. Nair continued as Director of Statistics till 1957 when he relinquished charge both as Professor and Director of Statistics to take up the appointment of Statistical Adviser to ECAFE, Bangkok in 1957.

### AS A TEACHER

Dr. Nair was a very popular teacher very much admired by his students and colleagues. His deep set voice coupled with his charisma had an arresting influence

on the listeners. He has a natural gift to choose the choicest words and place the correct emphasis on syllables to bring out the full potent of a word. He would bring in all sorts of similes from practical life to bring home a point effectively even when he was proving a mathematical theorem.

His last public activity was the inaugural address of the seminar on teaching statistics organised by the Kerala Statistical Association and the Department of Statistics, University of Kerala on 28th September, 1980. The speech was a testimony to the greatness of Dr. Nair as a teacher. We are concluding the memoir by quoting his last address.

"I am coming back, here, after 25 years to participate in your activities. This seminar is a very serious one, where most of you, will engage in fruitful discussions. In 1930, statistical theory was taught in Maths. Hons. Course, where Statistics was a special subject. In early days, statistical theory was not available. But probability theory, developed for purposes of gambling of rich persons, was taught.

Then, scientific technology were not developed. Hence, physical concepts of nature were far from what we see to-day. Infinitesimal elements make the world. These are elements which are not observable. Millions of such elements, produce a certain observable fact. In an aggregate of infinitesimal individuals there is an aggregate regularity and that aggregate regularity is the present day study of Statistics—Aggregates are non-measurable for physicists. Probability has come as a tool of this.

In those days, statistics was like this—What are the averages ? How is variation measured ? What is correlation coefficient ? What is regression ? With these questions, teaching of statistics during 1940's had only the aim—Student's Pass—this is a way of sinners.

Make the students trained in the techniques and mechanisms. This is an absolute necessity. Facilities are here for appropriate study. The Parallel college systems must be considered as untouchables. Instil a feeling of happiness, that I have learned something new. Discourage private tuitions. Give guidance and develop more of scientific thought".

R. N. PILLAI

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P. K. Richter

P. K. Richter

# **PRATAP KRISHAN KICHLU**

**(1899-1982)**

**Foundation Fellow**

## **EARLY LIFE**

Professor Pratap Krishan Kichlu, D.Sc., FNI breathed his last on 8 September 1982. His passing away extinguished the life of a savant and doyen of Indian experimental physics, especially of applied optics.

Pratap Krishan born to illustrious Parents Praduman Kishan Kichlu and Shrimati Kailaspati Upadhyaya on December 8, 1899. Pandit Praduman Krishan a contemporary of Pandit Moti Lal Nehru was among the first law graduates of the Punjab University and became the Chief Secretary in the government of Maharaja Pratap Singh of Jammu and Kashmir. His father Rai Bahadur Pandit Bihari Lal was a top administrator with the British Indian Government. He was a learned man and knew several Indian languages including Persian and Pushto. Pratap Krishan's maternal grand father taught Persian at the Canning College, Lucknow.

## **CAREER**

Pratap Krishan passed his matriculation in 1917, B.Sc. with Physics in 1921 and M.Sc. in Physics in 1924 from Punjab University. He wanted to study further for a doctorate degree. He went to Allahabad University—the great seat of learning in those days and met Prof. Meghnad Saha the leading physicist. The latter told Kichlu that he was late and admissions were over. It is said that as the meeting proceeded, Saha found something in Kichlu's request and pleasant insistence for an opportunity to learn further at Allahabad that Prof. Saha admitted him as a very special case. Pratap Krishan Kichlu thus not only received his D.Sc. degree from Allahabad University in 1927 but became Prof. Saha's most admired student. Soon after he joined Patna University. He became a Fellow of the Indian National Science Academy.

In 1929 he moved over to Panjab University in the Physics Department and in course of time became Professor of Physics. In 1930 he went abroad with Prof. Saha. They visited renowned centres of education in Europe and in England. It was during this tour that he was convinced of the need for self-reliance

in science, especially so in case of scientific and industrial instruments and components. He decided to devote himself in the pursuit of his new understanding and undertook a variety of development projects. Under the CSIR research schemes he engaged young M. Scs as research assistants for assisting him in these projects. The items of development were highly relevant to the times. These were developed to working prototypes and the techniques of making these were well documented. These reports were sent to CSIR where either no one bothered or no one had the ability to discern their importance and level of achievements. Years of good work of so many persons only hibernated there. Gradually his interest got concentrated on optical instruments.

I met him for the first time in 1942 on my admission to B.Sc. Hons. School in Physics. Professor J.B. Seth was Head of the Department. Next in line was Prof. P.K. Kichlu and then Shri B.M. Anand. Three other Visiting Professors I remember were Dr. Mela Ram, Prof. Sarna and Prof. P.N. Kalia.

The students could approach Shri Bal Mukand Anand freely but were generally afraid of going to Prof. Kichlu. His name Pratap Krishan could be known only because Prof. Seth addressed him as Pratap Kishan.

The Department of Physics at Lahore was housed in a rectangular building. Two sides had rooms separated by corridors and the other two opposite sides had rooms outside and verandahs inside. One such wing contained the workshop. Next to it, at the corner of the adjoining side was Prof. Kichlu's laboratory. A part of his big room was occupied by a network of glass apparatus for studying phenomena connected with electric discharge through nitrogen. One could hear the sound of the discharge, when Prof. Kichlu was working late in the evenings. On one of the walls of the same room was the bracket, a bow and an oxy-hydrogen burner for drawing quartz fibres. He had built a quartz fibre balance. His room was very well equipped and stocked for experimental work. Inspite of the experimental activity it was always neat and in order. The room across the corridor was for his assistants.

Prof. C.V. Raman had come for B.Sc. Hons. School examination. He was there for 4 days and delivered three lectures in the auditorium of the Chemistry department. Physics did not have a big enough room. The lectures were on Colours in Crystals specially in Diamonds. As a young student I was extremely impressed by his oratory and vast store of knowledge. His complete involvement in what he was saying was evident from the manner of his speech when he would hold the collar of his coat with one hand and in forceful words explain his experiments and justify his conclusions. Prof. J.B. Seth and Prof. Kichlu were responsible for inviting him and organising these lectures.

On this occasion I came to know how much regard Prof. Kothari had for Prof. Kichlu. Dr. Kichlu had invited Prof. D.S. Kothari for our M.Sc. practical examination.

He was soft spoken but would put questions quick one after the other. He questioned me also in the same manner. I answered these well and with understanding. At last when I fumbled the viva stopped.

The Department of Physics at Panjab University, Lahore was smoothly run, dedicated and well respected for teaching, training and applied research in physics. The students were well occupied and were constantly striving hard to learn physics. This was due to ever vigilant and untiring Prof. Kichlu. Inspite of this, while doing experiments on diffraction gratings with different types of mountings requiring long exposure time, some of us managed to brue and take tea. This was secretly done atop the tower of the building. Narinder Singh Bhalla, Ved Prakash Puri and Inder Sen Kapur were partners with me in this recreational activity. But we all worked very hard.

After obtaining my M.Sc. in physics in 1946, I was accepted by Prof. Kichlu as a Research Assistant under him, in a research scheme financed by the Council of Scientific and Industrial Research. Thus, in the later part of 1946 I became one of the series of research assistants which Prof. Kichlu had year after year. My predics-sor was Mohinder Prakash Murgai. I recall Mohinder expressing his concern on my getting into a very difficult situation of becoming a research assistant to Prof. Kichlu. He said it was hard to pass a year. I registered the observation but continued.

The project assigned to me was to develop 'Diamond Technology' for industrial applications. Prof. Kichlu had collected some books on diamond technology and information about machines to work on diamonds. He had even ordered some of these machines. My assignment was to install and operate these machines, to cut and polish diamonds for various industrial applications, to duplicate these machines, and develop those which he had not imported.

A few days after my reporting for work, Prof. Kichlu met me in the corridor and asked what I was doing. I explained. But at noon when he was leaving for lunch, he again asked me what I was doing. When he returned after lunch he again asked me and repeated the same later in the evening. For a few days this questioning continued and naturally I was hard pressed to tell him that I could not have been doing so many new things in the span of 3 to 4 hours every day. The questions were embarrassing even though I was working hard. I remembered Mohinder's observation. Disturbed by this situation I could not sleep. It occurred to me that if I asked a question first it might help. With this scheme, I equipped myself with four or five valid questions every day. Some were related to the work I was doing and some not quite so related. Everytime Prof. Kichlu peeped into my room or met me in the corridor I was quick to ask him a question. He took pains to explain these to me and started appreciating me. To him it was an evidence of not only my hard work but more that I was interested. It was his quiet technique of making an interested person work.

He had borrowed a book and wanted some of its pages to be photocopied. In those days modern facility of photocopying had not been invented. He had an Agfa bellows type costly camera and a stock of process plates. He took me to the dark room, set up the book in front of the illuminating unit designed by him and got made from the shop. He placed the camera in position and focussed it. After exposing a plate he developed it. By now it was time for lunch. He asked me to carefully focus the camera on another page and wait for his return from lunch. I in my enthusiasm focussed the camera and exposed several plates copying the subsequent pages and also developed these plates. On his return when he came to know of this he was visibly annoyed expecting that due to inexperience I might have spoiled the plates. However, having sharp eyesight, being young and having handled a camera my father had brought for me when he returned from Cambridge, UK in 1936 I was able to focus this beautiful camera precisely. Therefore, the plates exposed by me came out sharper than the one prepared by Prof. Kichlu. His annoyance vanished. He was happy and asked me to finish the work and left for his room. Such quick were his feelings of annoyance as well as of appreciation of his students and colleagues. This made us strive to please him and in the process we learnt.

We decided to develop scientific means of finding the axes of diamond crystals precisely before mounting on the machine for cutting. I was to take X-ray Laue photographs at  $5^\circ$  orientations. He had a Coolidge tube and a big transformer, 100,000 volts at its secondary. I was to set up the equipment for my work. Since the transformer had been lying unused for quite some time and was unusually big and high I got on to it to clean and to draw connections to the tube. Having done so, sitting right next to the high voltage/terminals I was going to plug it to the mains when a warning flashed in my mind. I was stunned as to what I was going to do. Nevertheless, I got down and after a while I switched on the system.

Prof. Kichlu had given me a diamond slice he believed was a 111 cleavage chip. I was to align it normal to the X-ray beam in order to get a 111 symmetry Laue pattern. The pattern showed a symmetry indicating a wide divergence from the 111 direction. Yet I was not to reorient it. The exposure with the Coolidge tube was very time consuming. He was again disturbed. He asked me to set up a high intensity demountable X-ray tube. I did so. At this time I was appointed an examiner for High School practicals at Ambala. When I reached there, the centre was locked and there were no exams due to disturbances. On my return I found somebody had exploded an electric bulb filled with explosive on the demountable high intensity X-ray tube I had set up. Prof. Kichlu was shocked. He did not say much. Some time later he mentioned that he had accepted the Professorship at Delhi University. Therefore, I must pack up all the apparatus and equipment belonging to the scheme. It was very fortunate that alongwith his personal belongings he carried these items to Delhi well in time before the partition riots broke out. This was due to his forethought and clear understanding of the situation.

At the time of partition we had lost most of our belongings. Therefore, after about two months when I reported to him at Delhi I was wearing a kurta pajama and a chappal.

The Delhi University Physics workshop at that time consisted of a carpenter and his  $4\frac{1}{2}$  tools the 5th one being broken. Prof. Kichlu's first instruction was that I must try and set up a good workshop. Next, he found that there was a diagnostic X-ray unit in the American War Surplus purchased by the University.

I brought it out and started on the diamond X-ray patterns again. The diagnostic unit was meant for millisecond flash X-rays. To use it for crystal photographs was unprecedented. Nevertheless, I worked from 7 in the morning till 8 in the evening. The pattern continued to show the asymmetry.

Dr. Kichlu in his disappointment had almost written me off; the desired X-ray pattern was not coming and actual work had not even started. Meanwhile, in desperation I decided to quietly orient the crystal my own way. I got the 111 pattern. The diamond was a 3 2 1 slice. After that for a whole month I obtained series of patterns, each subsequent pattern oriented further by  $5^\circ$ . These Laue photos and their tracings I mounted on large mounting boards. Prof. Kichlu had not spoken to me for the whole month. Since it was time for the salary distribution he must have gone to the laboratory in my absence. He saw the photographs and the chart on my work table. He was overjoyed. He sent for me and complimented me. After that he never lost confidence in me.

Once Dr. M.N. Saha was at his residence at the Delhi University Colony when I was also there. I was working on developing the technique for replica gratings. I found it very interesting to note that Prof. Kichlu was more nervous in presence of Dr. Saha than I was in his presence.

I could narrate many more such interesting incidents. I had a long and rewarding association with him. I have narrated some only to highlight his golden qualities and his concern first for the work and then for the worker even though his interest in our welfare was no less.

Working with his assistants he developed the techniques of making quartz micro-balance, X-ray tubes, photoflash bulbs, diamond tools and diamond working machines, synthetic sapphires, vacuum furnace, calcium fluoride crystals, vacuum units etc, through research schemes and a large number of items otherwise. The technique oriented training for products to so many youngmen is an example of foresight and his unique contribution to the growth of technology at a time when few were even conscious of this need.

He always wore white khadi shirt and narrow pajamas. When going out he would put on a cream silken long coat. Though dressed simply he was very sophisticated in his ways. He felt annoyed with uncouth manners.

Under his care the workshop of Delhi University grew to a very competent level with many facilities and competent staff led by Shri S. Bhatia.

The M.Sc. laboratories were also equipped with advanced, highly relevant experiments for training at the M.Sc. stage mostly developed there. In this he was assisted by several colleagues but specially by Dr. Gopal Krishan and Shri Jugal Kishore. Prof. R.N. Rai, Dr. Ajit Ram Verma, Dr. K.S. Singvi etc., were his periodic visitors. Prof. Kichlu liked them. Prof. Kichlu respected competent technicians.

Prof. Kichlu retired from Delhi University in 1962. He then planned to set up a factory for design and manufacture of optical instruments and components. However, he was invited in October, 1963 to take over the Directorship of National Physical Laboratory, New Delhi. This invitation was extended on the behest of a very high-powered committee chaired by Shri Humayun Kabir the then Minister of Scientific Research and Cultural Affairs. Others in the committee were Prof. S.N. Bose, Prof. H.J. Bhabha, Prof. D.S. Kothari, Prof. A.K. Saha and Dr. S.H. Zaheer DGSIR. It is said that Dr. Zaheer was not keen on Dr. Kichlu.

Immediately on assuming the charge of NPL, Prof. Kichlu initiated several measures to rejuvenate this leading yet languishing institute so as to be able to fulfil its objectives. Had he continued for a few years, NPL would have been put on right rails for carrying out its assigned tasks rather than indulging in planned and unplanned conglomeration of projects. Unfortunately, he became involved in a conflict between autocratic authority and upholding of the fair practice in accordance with rules, regulations and norms. He left NPL in September, 1964.

Dr. Ajit Ram Verma recently gave me a small pamphlet dated February 6, 1965. In the preface of this Prof. Kichlu stated :

"The recent happenings at the National Physical Laboratory, New Delhi have been referred to in the press and debated in Parliament. When I was recently at Calcutta to attend the Indian Science Congress Session, a large number of eminent persons in science and in public life inquired from me about the circumstances under which I relinquished the Directorship of the Laboratory. It was difficult to answer these queries in detail. For this, as well as in the interest of science, this note, giving a resume of the events, is being published.

The note is intended to provide factual data for a case study of the trends in the pattern of administration of science in India. All facts mentioned are supported

by documents which are given in the Appendix; and to the best of my knowledge no documents relevant to the case have been left out. It is hoped that an objective study from the material presented can be made.

I have refrained from expressing any opinion. *There is no intension to vent any personal grievances and I bear no bitterness towards any one involved in the controversy.* Nor do I regret having left the NPL, since I am usefully engaged in developing optical instrumentation a subject in which I have been deeply interested and am contributing in my own way to this important field of scientific research and development in our country.

I take this opportunity of expressing my satisfaction and deep appreciation of the approval by the Executive Council of the NPL of all my proposals for reorganisation and programming of work at the Laboratory two days before I left.

I must also thank gratefully my colleagues at the NPL who extended to me their whole-hearted co-operation during my stay at the NPL. The closeness of our association found expression in the rare courage they showed in writing to Prime Minister Shastri requesting him to persuade me to continue to hold office.

Professor Kichlu's greatness lay in the statement in italics in the above quote. All of us who worked with him knew it to be so. If he was annoyed he said so at our face, next moment when he was pleased he expressed that too. He never carried these in his mind for later settlements.

The NPL episode was the example of one of those pockets of extreme autocracy sprouted and nourished in the world's greatest democracy destroying right decisions and right practices. CSIR seems to have continued in this mode of egoistic management or mismanagement. This is one of the few major reasons of its failure to deliver the science and technology expected of it.

Professor Kichlu then devoted himself to his factory. He was assisted by Dr. B.K. Agarwal and his elder brother in initial stages of establishing the factory. In a short time it became the Adam Hilger of India similar to the Adam Hilger of UK in earlier days. You name an optical component and Prof. Kichlu was willing to produce it for you. Optical flats to  $\lambda/10$ , graticules of a variety, special prisms-doves, roofs, cubecorners etc., Lummer Gherke, birefringents, Wollastons, grating replicas upto  $2\frac{1}{2}$  inches, Schimdt plate, Fabry Perot etalone, autocollimators, Michelson and Fabry Perot interferometers, and what not. All these were produced to high standards at a small workshop in a rented house in Kamla Nagar, Delhi, where he worked with his own hands alongside his assistants.

I offered to join him at a salary and a percentage in the profits. Some how he did not feel it correct to uproot me from a permanent government job. Had I joined him, the course of my life and the history of this factory might have been very different. Nevertheless, every time I went to meet him at his factory, I learnt something more, something new. It was always a rewarding and refreshing visit.

In recognition of his life-long and lasting contributions to the field of industrial and applied optics he was awarded the Megh Nad Saha Memorial Gold Medal by the Asiatic Society in 1980.

I was fortunate to receive the set of notes he had made during his persuit of optics technology. Some were hand written others typed and yet others in reprints. The Scientific Advisory Committee and the Executive Committee of Central Scientific Instruments Organisation (CSIO), Chandigarh felt that these could be of value to the professionals and be preserved. They desired CSIO to organise, edit and print these as a special issue of CSIO Communication. In April, 1983 when I retired from the Directorship of CSIO the manuscript was ready for press. It has since been printed after several reminders to the new management.

Shri Ram Prasad, Scientist at NPL, writes : "P.K. Kichlu died a bachelor. Most of his scientific contributions and collections belonged to the institutions he worked with. Yet, he left behind some books, materials, tools and instruments as private property and these reliques are to form the nucleus around which "P.K. Kichlu Museum, Library and Hobby Centre" will be built in the hills of U.P."

These reliques do not include his collection of Gandhian literature. P.K. Kichlu was a Gandhian in his philosophy of life. He lived a simple life and wore khadi. The Gandhian literature that was left behind by P.K. Kichlu was gifted away to Srimati Kamla, Director Gandhi Memorial Centre, 4748 Western Avenue, P.O. Box 9515 Washington, D.C. 20016."

Dr. D.S. Kothari had brought Dr. Kichlu from the Punjab University to Delhi University. They had great mutual regard for each others high abilities. Dr. Kothari wrote in his communication of July 7, 1984.

"Prof. P.K. Kichlu was one of the most distinguished experimental physicist of our country. His contribution to applied optics and optical industry was in many ways pioneering and of very great importance. I was previleged to know him intimately and I always held him in the highest esteem for his scientific work and striling qualities of head and heart. I am glad that CSIO is bringing out this special volume devoted to the compilation of handwritten notes by Prof. Kichlu dealing with some of the most important aspects of optical workshop practice and industry. These

would be of much value of those engaged in this field. We are grateful to Dr. Harsh Vardhan and his colleagues for making these publication possible."

Prof. S.D. Chatterjee wrote on May 23, 1984 : "Thank you for your letter No. HV/Chat/5 dated May 15, 1984. Unfortunately, I had never been in close association with Prof. Kichlu. I met him only twice—once at Lahore in early forties at his residence and second time at New Delhi in 1978 also at his residence. Nevertheless, I cherish highest regards for his wizardry in instrumentation, generosity, humility and gentlemanliness."

Dr. J.N. Nanda wrote on June 1, 1984 : 'This is a most welcome opportunity to pay my tribute to my teacher Prof. P.K. Kichlu who not only taught me his emphasis on fundamentals of Physics and guided my research for the Ph.D. degree besides giving me the opportunity to know him as a friend and my wellwisher throughout his life.'

The first time I met him was in 1939, when after completing my B.A. degree examination, I enquired from him before joining the Honours School course at the advanced level as to the career possibilities. He did not take kindly to the enquiry at all. He categorically explained to me that the Honours School was meant only for those who sought to learn physics and not for those seeking lucrative employment. Throughout my subsequent life I have verified his summing up and funnily enough he has always been in the fore-front of my referees and helpers in my career. No one could but pick up habits of hard work from him. He was as a routine throughout the year in his laboratory at 9 AM and stayed there without any lunch break till 6 PM. All of us enjoyed having faculty tea with him at 3 PM when discussion scientific or otherwise was quite free and frank and often we had visiting faculty or friends from other departments. The tea was managed each week by members in turn. Prof. Kichlu always wore Khadi an Indian style of dress. He had truly a modern secular and nationalist approach to the world. He had great regard for his teacher Prof. M.N. Saha and his guru-bhais. When I had already published four research papers, he asked me to embark on a major research project arising out of my researches. Then apparently with great hesitation I asked him if I should write my Ph.D. thesis first. He laughed outright saying that I could have written thesis long ago, but he had felt that this compilation work would only be a distraction, when I was engaged on such a promising course of investigation.

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Dr. D.S. Kothari, Head, Physics Deptt., Delhi University; Scientific Advisor to Ministry of Defence; Chairman, University Grants Commission; Chancellor, Jawahar Lal Nehru University; Foreign member USSR Academy of Sciences; FNA; FASc; FNASC.

Dr. S.D. Chatterjee, Prof. Jadav Pur University; Visiting Scientist, Indian Association of Cultivation of Science and BARC Uidhm Nagar Calcutta.

Dr. Jitendra Nath Nanda, Prof. Delhi University; Director, Defence Materials Research Laboratory, Kanpur; Dean Institute of Armament Training; Prof. Punjab University; Ex-Executive Secretary, INSA.

Prof. Kichlu was very skilful in experimental techniques. Our M.Sc. experimental laboratory at Lahore had many equipments set up for most modern advanced experiments by the students under his inspiration. For my own research when I needed a strong ultraviolet source he did the entire construction of the same involving glass blowing of high order. In our laboratory, construction of optical components, quartz fibres, graded seals, coating of photographic plates, preparation of special equipments was taken up as routine activity and many local institutions sought his help for efficient use of their equipment. He was an excellent scholar of German and before long, under his inspiration, I myself became proficient in it. He often took time off on Sundays, to help me understand frequent references in German that I wanted to study.

He was an excellent host with a wide circle of friends including his ex-students. He could very happily billet any of his students proceeding to Delhi or Calcutta etc., into the houses of his colleagues. I enjoyed his hospitality almost to the end of his busy life. Conversation with him would excite objectivity and kill prejudice. He had great confidence in Indian skills. He encouraged his students to learn and to meet all technological challenges. He placed great value on hard and sincere work and discouraged trivial publications. He had the farsight to take only one or two students at a time for research. Honours came to him unbid. Towards the end of his life he was very happy to be awarded the Asia Society Medal. His extraordinary technological skill was evident when he transformed his illiterate employees into makers of sophisticated optical instruments valued all the world over."

Dr. S.K. Trehan communicated on June 18, 1984 : Some reminiscences of association with Prof. P.K. Kichlu. I had the good fortune of having Prof. Kichlu as my teacher during my M.Sc. at Delhi University in years 1950-52. He was incharge of the M.Sc. Laboratories. It is very heartening to recall some of the very penetrating remarks which he would often make. As a laboratory guide he was absolutely superb. He always emphasised the need to be meticulous and methodical in planning and execution of any experiment. I recall very clearly the events when we were trying to set up the experiment on X-ray scattering (Bragg reflection and Laue spots). The laboratory had just been shifted after NPL had cleared out of the Science Blocks of Delhi University. We were trying to fix the high-tension supply. The conventional insulation procedure in those days used to be the use of ordinary connection wire in the laboratory and to cover this with glass tubes. He had been doing this in the afternoon and some glass tubes had been littered on the floor. Prof. Kichlu walked in the laboratory and happened to walk on some of the glass pieces which were lying on the floor. This annoyed him no end and he told

us quite bluntly that this was not the way to do the experiment : even an ordinary kitchen is neater than this place. We must keep a waste paper basket to put the broken pieces and he emphasised that while we were certainly going to forget the Schrodinger equation and the Bragg-spectrometer after our M.Sc. it is the habits which we will carry along. It would be foolish to forget this point and one wonders as to how many teachers would do this today.

Dr. Kichlu was a great teacher; he practised discipline no end on himself and that used to be a sufficient guide for us that things have to be done in the proper manner. While trying to set up an experiment on the e/m of electrons, I was trying to make a vacuum chamber. This had to be fitted with glass plates. I was having considerable difficulty in finding suitable plates which would bear the stresses due to the high vacuum. Prof. Kichlu advised me regarding the correct thickness which I should use and also the sealing which would make it quite vacuum proof. His advice, needless to say, worked as it always did. Prof. Kichlu was an extremely warm hearted person who looked after the welfare of his students very well.

Prof. Raj Kumar Verma wrote on June 22, 1984:

"I had joined as Research Assistant under Prof. P.K. Kichlu in Sept./Oct. 1950 at Delhi University in a CSIR Scheme "Production of synthetic crystals of Alumina". Worked under this scheme till June 1953, when I joined as Lecturer in Physics Dept. University of Delhi.

Throughout the period of my work with Prof. Kichlu, he was a father-like figure for me. I used to hold him in awe and was somewhat afraid of entering his room, which was next to the laboratory where I worked. Prof. Kichlu was an excellent guide and used to treat me like his own son. Almost daily he used to ask me about the progress of work and I had to be ready to discuss with him any problems/difficulties faced by me.

Prof. Kichlu was a man of cool temperament, thoroughly honest, sincere, devoted and very hard-working. He was highly disciplined in his daily routine, extremely punctual in office work. These qualities left an indelible impression on my mind and I tried to emulate his example in my daily life.

After my return from USA, I met Prof. Kichlu at his residence a number of times during 1969-70. He always used to receive me and the members of my family

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very affectionately. He showed keen concern in the progress of my career and my being. I used to feel very happy after meeting him. It used to give him great pleasure to see his students doing well in their profession.

Prof. Kichlu has been a source of inspiration for me ever since I met him in 1950. His figure remains like a shining star before my eyes. I have come across very few persons in my life who have had such high standard of morality, competence in their work and consciousness of their duty. Prof. Kichlu had a rare quality of inspiring the research students working under him to achieve high degree of excellence in their work. I am grateful to have had an opportunity of working with him for a period of three years !

Professor Kichlu I had known earlier as my teacher in Spectroscopy in M.Sc. First time I really met him was in July, 1961 when I went to him for a research job. The very first day I got my first lesson. He constituting one man interview committee picked up a small rod and asked me to guess its length. My guess had been correct within 2 percent. I got the job and he remarked that a person who has to design and fabricate equipment for R & D to have correct idea of dimensions.

On joining him I went to one of his earlier and very capable disciples, Dr. Harsh Vardhan at the Defence Science Laboratory. Dr. Harsh Vardhan said that he is happy to meet a Gurubhai but at the same time had been kind to warn me. He told me that Dr. Kichlu is a hard task-master. The comments came true just after two weeks when I spoiled one his equipment one evening by accident. Next morning after a very brief reproach, he set on to the job of setting it right asked me to assist. After six hours of non-stop work, when he set it right, he wiped the sweat from his forehead and said "This is the way to work" This had been my second and the most important lesson from him.

Hard task-master though he was, he was very understanding. Very soon he could know that I work better when independent. He gave me the project, told me to go to the workshop and get the vacuum furnace fabricated for growing crystals of calcium fluoride. For months that followed, he did not ask me the progress till I went to him to come to my room to see the furnace I had made. Satisfied with the first phase, he gave me the next task to melt floorspar and grow a crystal. Then came the most glorious moment of my life. I showed him first transparent crystal. He was in the corridor, he saw the crystal carefully and ascertaining that it was a single crystal he jumped with joy and said "You have done a good job, Country needs persons like you". These words of encouragement set me on a track and I am going on and shall go on till end.

He was a man who would do his duty and would like others to do the same. When a few teachers came to sell him tickets for collecting money for National Defence Fund, he was annoyed. He told them that you all combined cannot collect

enough funds for one day's expenditure of our armed forces. They should devote this time to their job of teaching and shaping the future of the country. He had shaped and guided the destinies of many of us.

He had been kind, sincere, upright and unbending as a person, keen and devoted worker as a scientist. Many who were fortunate to be close to him, shall remember him forever as one who gave direction to the life they are living."

There are many others some of whom I have not been able to contact others have not responded. I beg pardon for my omissions and limitations. I am the most fortunate of them all to have had a very close and long association with him. Even when I was working in the Defence Science Organisation he would borrow my services for critical development work. It was during one such assignment that the technique of preparing diffraction grating replicas was developed for the first time in our country. In another assignment a ruling engine for diffraction grating for 10,000 lines per inch was built. In June 1975 he came to see CSIO and was very pleased to see the place humming with activity. He wrote : "The spirit you have created during the very short time you have been there, fully justifies my expectations."

Two or three time in a year I and my wife Urmila would go to see him at his residence in Maharani Bagh, New Delhi. He was very pleased to discuss, apart from Science and Technology about flowers and plants and their care with Urmila who is also keenly interested in these.

In early 1982 when I and my wife went to see him at his residence he got very emotional. He said he was loosing memory.

I owe a great part of my career to Professor Kichlu besides Prof. D.S. Kothari and my father Dr. Ramji Narayan, DSc (Ph.D Cantab). The Science and Technology I could acquire and practice is from Professor Kichlu, the savant. His confidence in my ability was a great encouragement. He was not only a great applied scientist but a fine human being.

HARSH VARDHAN







Siraj Ajmik

# **NIRBHAYASHANKAR AMARJI YAJNIK**

**(1894-1963)**

**Elected Fellow 1940**

## **BIRTH, PARENTAGE AND CHILDHOOD**

**NIRBHAYASHANKAR AMARJI YAJNIK**, son of Amarji and Manekba Yajnik was born at Ranavav, a taluk town in the earstwhile princely state of Porbandar on 28th November 1894. At the time of his birth his father, Amarji Yajnik, was the headmaster of a composite school at Ranavav. Soon after his birth his father was transferred to Porbandar, where Nirbhayashankar spent his childhood and had his school education.

## **FORMATIVE INFLUENCES ON THE YOUNG SCIENTIST**

These were the years when he was very much under the influence of his parents and teachers. Under this influence he grew up to be a teetotaler and strict vegetarian. Influence of his father, who was the headmaster himself of the school where Nirbhayashankar studied, inculcated in Nirbhayashankar great qualities of head and heart. He was always very helpful to his students who consulted him even for their personal problems. His students respected him very much and his many qualities made him a model teacher as he himself practised what he preached.

## **SCHOOL AND UNIVERSITY EDUCATION**

Shri Nirbhayashankar had his schooling in Porbandar High School where his father was the headmaster. He was a brilliant student and passed his matriculation from Bombay University with distinction. Bombay University in those days was a very prestigious University and to pass with distinction for a student from a small place like Porbandar was taken as a big achievement.

He joined Wilson College, Bombay, for higher education and passed B. A. examination from Bombay University in 1914. He continued his studies in Wilson College and passed M. A. examination in Chemistry from Bombay University in 1916 with flying colours.

Later in life while at Forman Christian College Lahore, he was associated with Punjab University Chemical Laboratory. He started his research in various fields of

Physical Chemistry especially Colloid Chemistry and had numerous research publications mostly in very prestigious journals. His published work is covered under the headings—Colloids, Gels, Sols, Emulsions, Magneto-Chemistry, Photochemistry, Radio Chemistry, Analytical Chemistry and even Industrial Chemistry. In 1934 on the basis of research he had done and research papers he had published he supplicated for the D.Sc. degree from Bombay University and was awarded the same.

### PROFESSIONAL CAREER

After passing his M.A. examination in Chemistry in 1916, he joined St. John's College Agra as Assistant Professor. In 1919 he shifted to Lahore where he joined F. C. College as Professor of Chemistry. In the first batch of students at F. C. College was Mr. Shwanti Swarup Bhatnagar who later became the Director of the University Chemical Laboratories, Lahore and first Director General of the Scientific & Industrial Research, Government of India and was knighted by the then Government. Dr. N. A. Yajnik was also associated with Postgraduate teaching of Chemistry in the University Chemical Laboratories and was designated as Reader in Chemistry.

In 1940 he joined Punjab University Chemical Laboratory as Professor of Physical Chemistry when Dr. S. S. Bhatnagar, Professor of Physical Chemistry and the Director of the University Chemical Laboratories, left Lahore as the first Director General of the Scientific and Industrial Research. In 1941 when Prof. J. N. Ray left the Laboratories for War Service he became the Director of the University Chemical Laboratories.

In 1939, 'Tatas' set up Tata Chemicals, a heavy chemical industry at Mithapur, with Shri K. H. Vakil, a chemical engineer and a well known nationalist, as its Technical Director. Shri Vakil was actually asked by Mahatma Gandhi to develop Chemical Industry in India. Shri Vakil knew Dr. Yajnik very well and consulted him for the solution of the various problems which arose while he was setting up the chemical industry at Mithapur and in the end was able to induce Dr. Yajnik to join Tata Chemicals, Mithapur as Chief Chemist of the Analytical and Research Laboratory in 1942.

Dr. Yajnik did excellent work and due to his efforts and insight this Laboratory became the best of its kind in India.

In 1946, Shri K.H. Vakil who had worked very hard in setting up this industry died of heart attack. Dr. N. A. Yajnik resigned his position soon after the death of his friend who was instrumental in bringing him to Mithapur from Lahore. During the period 1942 to 1946 when he was at Mithapur he was able to develop, as has already been mentioned, a fine Analytical Laboratory and a Laboratory for research in chemical technology required for heavy chemical industry dealing with common salt

and other related marine and other heavy chemicals being manufactured at Mithapur.

His interest in education impelled him in setting up the Gujarati College, "Parikh Baldevdas College" in Indore in 1951 and during the difficult years of its growth he acted as Honorary Principal of the same. When this college was on sound footing in 1955 he left Indore to set up his own chemical industry, the Kemicolor Industries, in Bombay and asked Jayant Yajnik his son, who had passed his M.Sc. (Hons. School in Chemistry) from Panjab University Lahore in 1939 and who was working as a Lecturer in Chemistry in one of the Bombay Colleges, to manage it.

Dr. Yajnik's last days (1955-63) were very happy. The Industry he had set up was flourishing and was being managed by his only son Jayant. Dr Yajnik was passing his days happily and had no worries and lived in Bombay almost a retired life. In 1963 he went to his native place in Gujarat "Madhavpur" where he died after a brief illness. Jayant N. Yajnik passed away in 1975 and this Industry is now being managed by Dr. N. A. Yajnik's only grandson, Gurujan J. Yajnik and is known as Dr. Yajnik's Kemicolor Industries Pvt. Ltd.

### HIS CONTRIBUTIONS TO NEW KNOWLEDGE

The research work of Prof. N. A. Yajnik falls in the general area of Physical Chemistry namely, in Colloids and related fields. However, he conducted a variety of studies. His work could be summarised under the following sub-titles :

- (i) Studies of Binary mixtures
- (ii) Adsorption
- (iii) Gels and Sols
- (iv) Emulsions and soaps
- (v) Physico-Chemical investigations.
- (vi) Magnetochemistry
- (vii) Photochemistry
- (viii) Radiochemistry

Besides the above main fields he also worked in the area of analytical chemistry, and on neem oil, a natural product. His work is not only important from the point of view of fundamental research, touching some basic principles of Chemistry, but it also has a direct relevance to the Chemical Industry. A brief summary of his work

containing some prominent features, under the subtitles mentioned above, is being summed up in the following pages.

(i) *Studies of Binary Mixtures* : He tried to explore the possibility of the existence of a correlation between vapour pressure and viscosity as also vapour pressure and surface tension of some binary mixtures. For example, on the basis of vapour pressure and viscosity measurements, conducted at various temperatures of the binary mixtures : toluene/bromobenzene, toluene/iodobenzene, benzene/bromobenzene, benzene/ethylene-dichloride, propylene dibromide/propyl alcohol, ethyliode/methanol, pyridine/butyl alcohol, pyridine/acetic acid, chloroform/acetone, acetone/carbon disulphide, carbon tetrachloride/ethyliodide and ethylacetate/ethyliodide, the following correlations were deduced :

- (a) When the vapour-pressure curve was a straight line the viscosity curve was also a straight line.
- (b) If the vapour-pressure curve passed through a minimum the viscosity curve passed through a maximum and vice-versa.

The limitations of the empirical correlations between the viscosities of mixtures and the components, were ascribed to the association, dissociation and volume changes which took place on mixing.

Surface tension of a number of binary mixtures for which the vapour pressure data were already known was measured and it was suggested that Volkman's formula for calculating the surface tension of binary mixtures was applicable only to a limited number of systems.

(ii) *Adsorption* : It was shown that charcoal, and alumina and silica gels were capable of absorbing both acidic as well as basic dyes. However, charcoal proved to be the most efficient. On the other hand it was found that the hydroxide of aluminium, iron and chromium absorbed the anions of the type,  $C_2O_4^{2-}$ ,  $NO_3^-$ ,  $CN^-$ ,  $BrO_3^-$ ,  $CNS^-$ ,  $[Fe(CN)_6]^{3-}$ ,  $CrO_4^{2-}$ ,  $MnO_4^-$ ,  $[Fe(CN)_6]^{4-}$ . The absorbability was assigned to the possibility of the formation of insoluble and complex salts. More interesting were the experiments on the absorption of binary mixtures by animal charcoal and a comparison of the absorbing power of different varieties of charcoal was also made. The solutes chosen were the alkaline earth and the alkali metal salts. From a study of a number of binary mixtures the effect of the presence of one solute on the adsorption of the other was also studied in detail.

(iii) *Gels & Sols* : A large number of gels and sols were investigated for such properties as coagulation, gelling time, surface tension, velocity of sound, thermal stability and

their photochemical sensitivity. The coagulation of zinc and copper sols by the addition of non-electrolytes was attributed to the removal of the protective layer on the sol. The stability of the sol is dependent on the changes of dielectric constant. Relative orders of a large number of electrolytes have been found out which influence the transparency of silicic acid gels. Thus it was found that the light-absorbing power of  $\text{SiO}_2$ - gel is affected by metal sulphates in the following order :

$\text{Na}_2\text{SO}_4 < \text{Al}_2(\text{SO}_4)_3 < \text{K}_2\text{SO}_4$ ; whereas metal chlorides and metal nitrates followed the order :

$\text{LiCl} < \text{NaCl} < \text{KCl} < \text{CaCl}_2 < \text{SrCl}_2 < \text{BaCl}_2 < \text{HgCl}_2$  and  $\text{LiNO}_3 < \text{NaNO}_3 < \text{KNO}_3 < \text{Ca}(\text{NO}_3)_2 < \text{AgNO}_3$ , respectively. At the same time the phosphates were found to decrease the light absorbing power at low concentrations only. In general, the light absorbing power was found to be sensitive to the presence of electrolytes and was increased by them in the order :

Phosphates—sulphates—chlorides—nitrates—hydroxides. Among the organic compounds, sugar and acetic acid decreased the light absorbing power of silicic acid gel.

A very interesting study of the photo-chemistry of gold and silver sols was also carried out. Experiments were undertaken to determine the effect of air and light on these sols when they interacted with  $\text{As}_2\text{S}_3$  and  $\text{Sb}_2\text{S}_3$ . It was suggested that  $\text{H}_2\text{S}$  produced in the presence of air and light, further reacted with these sols to yield sulphides of silver and gold which were responsible for colour changes in these systems.

Industrial uses of various Indian gums on the basis of their physical properties were also studied.

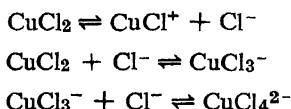
(iv) *Emulsions and Soaps* : He was able to establish that there existed a close similarity between mechanical dispersion and emulsification for the purpose of saponification. Thus the saponification rate of peanut oil emulsified with distilled water mechanically or by peanut oil soap, increased with increase in the degree of dispersion of the oil and also with increase of volume of the oil phase. Saponification rate also depended on the nature of the medium, e.g., ethyl alcohol enhanced the rate of saponification markedly. Successful attempts were made to study, semi-quantitatively, the emulsifying power of emulsifiers. Thus it was found that sodium palmitate had a higher emulsifying power than sodium stearate. Also, a soap solution with lower surface tension has a higher emulsifying power. In addition to this the viscosity and iridescence properties of a few emulsions and soap solutions were measured. Suitable methods, based on the measurement of surface-reflection and surface-tension were devised to compare the texture of commercial soaps.

(v) *Physico-chemical Investigations* : This part of his work includes a study of the effect of electrolytes on the viscosities and conductivities of organic solvents and the influence of electrolytes on the solubilities of some organic acids in water. It was shown that the ionic dissociation directly depended on the dielectric constant of the medium. Most interesting, however, were his experiments on the solubilities of organic carboxylic acids in water which indicated that small concentrations of some electrolytes greatly enhanced the solubility of carboxylic acids.

From several measurements made on the determination of viscosities of solutions of  $\text{HgCl}_2$ ,  $\text{CoCl}_2$  and  $\text{CuCl}_2$  in admixtures with other chlorides he was able to suggest the existence of the complex ions,  $\text{HgCl}_4^{2-}$ ,  $\text{CoCl}_4^{2-}$  and  $\text{CuCl}_4^{2-}$  respectively.

(vi) *Magnetochemistry* : Valuable evidence was collected regarding the valency of colorant ions in glasses by measuring the magnetic susceptibilities of the paramagnetic ions which coloured the glasses.

The changes in the colour of cupric chloride solution accompanying changes in concentration of hydrochloric acid were monitored via solution susceptibilities. A few susceptibility measurements were also reported at slightly higher temperatures. A few 'magnetic titrations' were performed wherein a break in the susceptibility-concentration curve for solutions of cupric chloride in water, methanol, ethanol, propanol and butanol were reported. These observations were explained on the basis of the formation of  $\text{CuCl}_4^{2-}$  via the following chemical equilibria :



The effect of the presence of ferric chloride in inhibiting the chlorination of  $\text{CHCl}_3$  was also investigated by studying the magnetic behaviour of  $\text{FeCl}_3/\text{CHCl}_3$  system in the presence of traces of moisture. It was suggested that in the presence of moisture, an unidentified hydrated complex of  $\text{FeCl}_3$  was formed which acted as an inhibitor for the chlorination of  $\text{CHCl}_3$ .

(vii) *Photochemistry* : He conducted experiments to study the effect of tropical sunlight on the inversion of cane sugar and designed suitable apparatus to study this phenomenon by employing various inorganic salts and dyestuffs as light filters. In this way it was found that the rate of inversion of cane sugar increased in the presence of sun light. The temperature coefficients of the following photochemical reactions was also reported :

- (i) Oxidation of  $\text{H}_2\text{S}$  in water by oxygen,

- (ii) Bromination of cinnamic acid, and
- (iii) Bromination of lactic acid.

*(viii) Radio Chemistry :* Using a modified Bumstead double electroscope, the radium content of a few Indian minerals was ascertained. U-ocher and Samarsakite were found to have a radium content of  $2143.4 \times 10^{-12}$  and  $1187.2 \times 10^{-12}$  gm/gm respectively. Large amounts of apatite—magnetite, occurring as yellow incrustation had a radium content of  $1324.9 \times 10^{-12}$  gm/gm. He extended these studies to the minerals of Travancore and Kashmir which too had some radio activity.

*(ix) Miscellanea :* (Industrial Chemistry) : In addition to this he also conducted experiments in many other diverse areas of Chemistry. He suggested a suitable method for the detection and removal of impurities from neem oil.

Some of Dr. Yajnik's work had direct impact on Industry. His work on neem oil, indigo hyposulphite for textile dyeing, use of catalysts in photosynthesis, saponification and emulsification of oils and a study of the physical properties of commercial Indian gums, are the notable contributions in this context. Apart from this,

- (a) he carried out a preliminary examination of the effect of electrodeless discharge on some phosphates, oxalates and carbonates;
- (b) he also suggested a new method for the gravimetric estimation of the alkali metals, potassium, rubidium and cesium using zirconium sulphate.

### **MEMBERSHIP OF NATIONAL/INTERNATIONAL SOCIETIES**

Dr. N.A. Yajnik was elected a Fellow of the National Institute of Sciences of India in 1940. He was a member of the Indian Chemical Society, an Associate Member of the Institute of Sciences of Indian and the Royal Institute of Chemistry, London.

### **MARRIAGE, WIFE, CHILDREN, PERSONAL LIFE**

Dr. Yajnik was married to Girija and they had only one child, a son, Jayant N. Yajnik in 1918/19 i.e. the time when Dr. Yajnik shifted from Agra to Lahore.

Dr. Yajnik was a teetotaler and a strict vegetarian and lived on Jail Road, a very good area, outside the walled city of Lahore. He had an amiable disposition and was socially acceptable in the literary circles of Lahore.

Prof. N.A. Yajnik left his University position early in 1942 to revert to his position in F.C. College from where he resigned a little later to join Tata Chemicals,

Mithapur. I (Dr. Paul) still remember Prof. Bashir Ahmed, Professor of Organic Chemistry, University Chemical Laboratories, and one of his (Dr. N.A. Yajnik's) earlier students, coming to me at about 2.00 p.m. one afternoon and asked me to arrange a farewell function for Dr. N.A. Yajnik at 4.00 p.m. I was then the Secretary of the tea-club of the University Chemical Laboratories. Dr. N.A. Yajnik had not told anybody that he was leaving for Mithapur that evening as he had reverted to F.C. College and had lost contact with the University. No invitation cards could be issued and messages were conveyed on phone to a few persons who could be contacted but the news spread like wild fire and at 4.00 p.m. there was a huge crowd of his students, admirers, friends and many people from the colleges in Lahore also joined the function besides University academic and administrative staff. The University Chemical Laboratories had not earlier had such a big crowd ever. This showed his personal popularity in the academic circles in Lahore.

Dr. & Mrs. Yajnik while at Mithapur did a lot of social work looking after the workers of the factory and their families. Dr. N.A. Yajnik was the founder member of Mithapur Club and its president while Mrs. Yajnik set up the Mithapur Stree Samaj and was its president. Thus they played a significant role in the social life of Mithapur.

R.C. PAUL  
SUNITI KUMAR

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Taswant Singh

## **JASWANT SINGH**

**(1901-1977)**

**Elected Fellow 1956**

### **EARLY LIFE AND EDUCATION**

**JASWANT SINGH** was born on December 4, 1901 in Gujranwala, Punjab, now in Pakistan. He came from a well-to-do family with landed property and business interests. His father was a prominent and popular person in the area. But Jaswant Singh, was more interested in academic and professional fields specially medicine, even from his early years. He lost his mother at the age of five years and his father did not marry again and looked after Jaswant Singh and his younger brother. He had his schooling in his home town Gujranwala and after his High School (Matriculation) Examination he persuaded his father to send him to Lahore, the capital of Punjab (now in Pakistan), for further studies with the objective of finally studying medicine which was always his dream.

In Lahore, he joined the premier and prestigious educational institution, the Government College for two years of Pre-medical science education and training leading to F.Sc. (Medical). His stay in Lahore enabled him to appreciate the contemporary modern active life style and environment of the city and enabled him to adjust to the western ways of life in Scotland (Edinburgh) and England (London) where he had all his medical and public health education and training subsequently. His father agreed to send him to the University of Edinburgh where he completed his medical degree M.B., Ch.B. in 1926. During his student days and later as the young officer in the Indian Medical Service (IMS) he was interested in sports and played hockey, tennis and in his later years played golf with some distinction.

### **CAREER**

After his graduation in Medicine and Surgery from Edinburgh University in 1926, initially he started medical practice in England jointly with a friend. But being more inclined to the field of public health and preventive medicine he soon joined the Indian Medical Service (IMS) at the age of 26 years and after training, was posted in North West Frontier Province as a Medical Officer. He worked in Military Hospitals as well as in the field as Regimental Medical Officer. Later he served in various capacities in Baluchistan and the North West Frontier Province.

He liked to up-date his medical knowledge and visited England and Scotland when on leave and took study leave to qualify for the Diploma in Tropical Medicine and Hygiene (DTM&H) in 1931 from the London School of Hygiene and Tropical Medicine. Later in 1934 he took training in Malariology at the Malaria Institute of India then located at Karnal. Little did he realise that he would join the Malaria Institute of India (M.I.I.) in Delhi and spend his most active and productive life there and finally hold the post of Director.

### JASWANT SINGH'S ROLE IN MALARIA CONTROL PROGRAMME

In 1938 he joined the Malaria Institute of India as Research Officer and became Assistant Director in 1940, Deputy Director in 1944 and finally after partition of the country he became the Director of the Institute in 1947. He had opted for the Civil Medical Services from the I.M.S. (a Military Service).

He was the main architect in the planning of the Nation-wide Malaria Control Programme (NMCP) which was launched in 1953. Realising the importance and the need for development of manpower resources for such a gigantic task he expanded and intensified the training programme at the Institute both for professional and senior sub-professional staff from the Centre and State. In so doing, he was able to develop a corps groups of experienced and trained all round malariologists in the country. He also promoted development of State level training centres for sub-professional staff.

Meanwhile following the policy and tradition of the Malaria Institute of India, research activities were geared up in all branches on the Science of Malariology both at the Institute and its branch at Coonoor. In order to do so he programmed for advance research training of some of the senior officers of the Institute in different institutes of U.K., USA and a few others, so that on their return they could be in a position to assist in the rapid development of the activities. In fact his long range vision helped to form another corp group of workers in the field of research activities. Because of this it was possible to establish the National Institute of Communicable Diseases in course of time.

It is also to his credit to open a wing at the Institute for the study and research on filariasis with field stations established in some of the States like Orissa and Kerala. Several training courses were held, and by mid fifties the National Filaria Control Programme was launched in the country.

Thus it is interesting to note that within a few years after taking over the Institute he planned in three directions in the intensification of teaching, research and control of malaria and filariasis. Incidentally he was also the motive spirit behind the switch over of NMCP to one of eradication from 1958. This was at the

stage when he became the Director-General of Health Services of India, the highest Medical post in the country in Civil life. In that capacity he was able to promote further the campaign for the eradication of malaria.

Meanwhile, he had already been elected as a Fellow of the National Academy of Sciences.

After his superannuation in 1960, he joined the World Health Organisation in the capacity of the Director, Malaria Eradication Training Centre (METC), then located at Kingston in Jamaica. He was thus again involved in training senior professionals from many countries which had embarked on the task of eradication of malaria.

In the final analysis Jaswant Singh became one of the outstanding Malariologists with international fame and therefore, he rightly deserved the Darling Award and Medal from the WHO in 1968.

Apart from these achievements he left an indelible mark in the field of stains and staining technique for malaria parasite in thick and thin films in the same micro-slide. The stain is known as J.S.B. after his and his colleagues name (Bhattacharjee). This replaced the imported Leishman and Giemsa stains. Only JSB has been in use in the entire country under the National Malaria Control/Eradication Programmes.

In the international field he served as a member of the WHO panel of Experts on Malaria and in that capacity attended several meetings in the different parts of the world. He also attended meetings of the World Health Assembly on several occasions as well as the International Congress on Tropical Medicine.

He also visited China as a Medical Expert in the delegation from India in 1955. The same year he was called upon to visit Indonesia to advise on the development of Malaria Institute in Indonesia.

In view of his special interest and contribution in the field of chemotherapy, WHO invited him to prepare an authoritative monograph on chemotherapy of malaria along with three other renowned scientists in field. This now remains as an important reference literature on the subject. His publications in scientific journals exceed well over one hundred and cover many fields.

He was associated with more than 20 scientific organisations.

### FAMILY AND PERSONAL LIFE

Lt. Col. Jaswant Singh was married in 1933 to Shiv Kumari Sehgal, daughter of a Chief Engineer in Indian Railways. They had three children two sons and a

daughter. Mrs. Jaswant Singh a well educated and accomplished lady has all along been a tremendous support and help to Jaswant Singh in many of his activities. His elder son is in business in the U.S.A. and younger son after a Doctorate in Management Science is employed in the World Bank (IBRD). His daughter is married to a petro-chemical engineer and settled in U.S.A. Lt. Col. Jaswant Singh was a kind husband and affectionate father always looking after his family members inspite of his busy schedule and commitments.

He was kind and affectionate to his wide circle of friends both national and international and officers and staff working under him. His charming manners with a ready smile won the admiration and loyalty of those who came in contact with him specially his colleagues and staff working with him. He was often firm without being offensive but never harmed anybody but helped many, sometimes without their knowledge. He was a man of few words and if a nod was adequate he was little inclined to speak. Many if not most of the people that came across him in India and abroad still remember him as a polished and cultured man, kind and affectionate, a father figure ready to assist and help.

A. P. RAY

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G. S. Prentiss

# **SIR CHARLES GERALD TREVOR Kt, C.I.E.**

**(1882-1959)**

**Foundation Fellow**

## **BIRTH AND EDUCATION**

**SIR CHARLES GERALD TREVOR Kt, C.I.E.** was born on 28th December, 1882. A few can claim the distinguished lineage as Sir Gerald. His father Sir Francis Trevor, K.C.S.I., C.B.E. and his mother Mary Helen Mytton belonged to two distinguished families of Walespool. His father served India as the Principal Medical Officer, H.M. Forces in India and was Colonel Commandant, R.A.M.C. Thus, Sir Gerald could claim his connection with India from his birth. His father Sir Francis had also the distinction to serve His Majesty, Emperor of British Empire as the Hon. Surgeon.

Sir Gerald had his education at Wellington College from where he joined Royal Imperial Engineering College at Coopers Hill for education and training in forestry. Thus, Sir Gerald had the opportunity of learning forestry at the feet of distinguished teachers who were holding the various faculty positions. His love for forestry was probably kindled for the opportunity to have an outdoor and active life as a forester which, living in nature in India, would provide with ample measures. His father's long association with India was perhaps the additional motivating force for the young man to take this decision.

## **SERVICE CAREER**

After completing his education at Coopers Hill, young (Charles) Gerald Trevor joined the Indian Forest Service as an Assistant Conservator of Forests in 1903. He was posted to the Punjab. He soon proved to be an able administrator, an accomplished forest manager and a keen observer of nature. He became the Deputy Conservator of Forests in 1911 in the Punjab. In 1920, he was promoted to the rank of the Conservator of Forests and was posted to the United Province of Agra and Oudh. In 1926, he became the Vice-President and Professor of Forestry at the Forest Research Institute and Colleges, Dehra Dun. Both the posts were subsequently abolished for administrative reasons. In 1930, he was elevated to the coveted post of the Chief Conservator of Forests, The Punjab and North West Frontier Province. Though principally preoccupied with administrative duties, nonetheless he found time to pursue research to advance knowledge in Indian forestry which was almost a clean

slate at that time with much scope for research and observations. His wide knowledge and administrative capability marked him out as an outstanding administrator and a forester which was soon recognised by the Government of India by appointing him in 1933 to the combined office of the Inspector General of Forests to the Government of India and the President, Forest Research Institute and Colleges, Dehra Dun. He continued to discharge the duties of this combined office with much distinction till later part of 1937 when he superannuated. Forest was under the administrative control of the then Department of Education, Health and Lands when Sir Girija Sankar Bajpai of hallowed memory was the Under Secretary to the Government of India.

### CONTRIBUTIONS TO FORESTRY

The forester and the scientist in Sir Gerald dovetailed into one another so smoothly, with such finesse, it is impossible to discern where one left off for the other to begin.

Soon after joining service, young Trevor engaged himself seriously in solving some of the intractable problems of natural regeneration of deodar, spruce and silver fir in the Kulu Forests. He prepared the Working Plan for the Kulu Forests in 1919-20 for the next twenty years. This Working Plan bears the stamp of erudition and deep knowledge of Trevor. The then Inspector General of Forests became so much impressed by the high standard of his work as to make personal visit twice to Kulu, a rare occurrence even in those halcyon days. He remarked that this was "a great advance on any similar production which has yet been used for the coniferous forests in the Himalayas". What a fine tribute to young Trevor!

While preparing the Working Plan, Trevor had to trudge precipitous tracks which showed his tremendous physical powers and endurance. In the words of Mobbs written in 1959 "his reputation in Kulu Valley lived long after he left there, for his silvicultural skill, his prowess as a mountaineer, and his firm but sympathetic administration. Many years later, and probably still, the forest staff would show visitors with pride the young forest crops that he had raised by natural regeneration." At Parvatipur in Kulu Valley, a deodar tree still exists which is known as "Trevor God" to the local inhabitants. Such was the love, affection and respect shown to Trevor by the local inhabitants. The Trevor legends were handed over from generation to generation by the grateful people.

He also standardised the techniques of forest nursery work in the hills which, by any standard, is the hall mark of his intimate knowledge of the artificial regeneration techniques in the Himalayan forests. During his tenure in the United Province, he published an account on "management of sal forests" which he personally presented in the British Empire Forestry Conference, Australia and New Zealand, 1928. The available records show that this paper was highly esteemed by the audience.

Similarly, his paper on "volume tables for single trees of the Himalayan Conifers" published in 1920 was received by the practising foresters with respect and admiration.

The "Manual of Indian Silviculture" written in collaboration with Sir H.G. Champion is still a much valued publication on the subject. It was based on data meticulously and patiently gleaned by him over the years from all over the British India. This book received laudatory comments from R.S. Troup, the doyen and the pioneer of the tropical silviculture research at that time, in the review of the book published in *Empire Forestry Review*. Though he primarily followed the Silviculture Systems prevalent in the continental Europe, nonetheless he improved the Systems considerably to suit the Indian conditions which has now come to be recognised as Indian Silviculture Systems as a separate entity.

His another book that earned him great reputation is the "Practical Forest Management" written in 1923 in collaboration with E.A. Smythies belonging to the I.F.S. cadre of The United Province of Agra and Oudh. He also codified "resin tapping instructions and rules" for the pine forests.

Sir Gerald had been a prolific writer and had published papers on varied topics ranging from silviculture and management, thinning, artificial and natural regeneration, nursery techniques, fire protection, disease incidence, exploitation, felling, transport and logging, forest maps, bamboos in India, etc. During his tenure as the Inspector General of Forests to the Government of India, he toured very extensively in different forest areas of the country and published tour inspection reports on forests of The Andamans, Assam, Bengal, Burma, Coorg, Madras Presidency, Orissa and Chota Nagpur, North West Frontier Province, irrigated plantations of Punjab, etc. These detailed tour reports are worthy of emulation. His profound and wide knowledge of forestry coupled with keen power of observations has made these reports a real treasure of knowledge worthy of preservation. He represented India at the British Empire Forestry Conferences held in Canada (1923), Australia and Newzealand (1928) and South Africa (1935). In recognition of his meritorious services in India, he was made a Companion of the Order of Indian Empire (C.I.E.) in 1933 and was conferred Knighthood in 1937.

### TEACHER IN FORESTRY

Trevor was also an accomplished teacher. His lectures used to be heard in rapt attention. During his tenure as Professor of Forestry at the Forest Research Institute and Colleges he exhorted, with polished suavity, his students and pupils to keep eyes and ears open during their sojourn in forests and publish observations for the benefit of posterity. In organising teaching and research activities in forestry, Sir Gerald had the ability to secure ungrudging and active support of all his junior colleagues.

### SOCIAL AND OTHER ACTIVITIES

After his retirement towards the end of 1937, he settled down at his ancestral home at Trawscoed Hall in Wels taking an active interest in his dairy and sheep farm. He was the proud owner of a prize-winning flock of Kerry Hill Sheep. He was rather prominent in all agricultural activities in Wels and took a leading part in the National Farmers' Union, the Royal Wels Agricultural Society, and County Landowners' Association. He was Treasurer, for many years, of the Guilsfield Agricultural and Horticultural Society. Ungrudgingly he used to allow his farm as the venue of the annual show organised by the Society, much to the discomfort of other members of his family.

Sir Gerald's profound knowledge of sheep husbandry was acknowledged by his election in 1957, as the Chairman of the Wels Regional Committee of the Scottish, English and Wels Wool Growers Ltd. In 1958, just one year before his death, he was elected Chairman of the Montgomeryshire Branch of the Royal Wels Agricultural Society.

In 1941, Sir Gerald was High Sheriff of Montgomeryshire and for 17 years a magistrate. He was also County Councillor for three years of Montgomery County Council and served on several committees. He was unseated in 1952 on account of his advancing age and indifferent health. Being highly religious, he was also a prominent and respected churchman. He held the office of the Church Warden in Guilsfield Parish Church for 25 years. At the time of his death, he was Vicar's Warden. He represented the Parish Church on the Wels Board of Patronage, the Ruridecanol Conference and Diocesan Conference. In addition, he was an active J.P. (Justice of Peace) at Welshpool for 17 years, being the Chairman of the Bench for much of the time.

Notwithstanding all the versatile activities as a farmer, sheep breeder, County Councillor, Justice of Peace, Church Warden, he did not desert his first love, the Forestry. He maintained, developed and expanded his woodlands at Trawscoed mainly comprising of oak, ash and conifers. He had his own plans of various forestry operations which he practised in his woodlands, always maintaining careful records. Department of Forestry, University College of North Wels, Bangor later prepared a Working Plan for his woodlands, primarily based on his clearly defined objectives of management, which he enunciated in his published papers while serving in India.

Forestry students of Bangor were always warmly welcomed to his woodlands for practical work under his benign and able guidance. He never missed this voluntary work. He also often lectured in the Forestry Society of Bangor. He tried for many years, like a man possessed, to transplant his ideas of natural regeneration in his woodlands in Wels but ultimately he resorted to plantings, as conditions in Great

Britain were not conducive to the natural regeneration which he advocated for the temperate forests of India.

### PERSONAL QUALITIES

As an administrator, Sir Gerald earned the love, respect and willing cooperation of his colleagues and subordinates. He never willingly hurt anyone, though he sometimes acted with a sort of benign rigidity, but he was the kindest of men. Whoever came in contact with him knew that his loving heart was full of compassion and generosity which he often displayed without fault even to stray acquaintances.

Sir Gerald had also an in-depth knowledge of Indian history, customs, and religions. He was particularly interested in Islam on which he could confound even the most learned.

Sir Gerald was stocky in built but handsome with a most charming and attractive personality. Though a silent and reserved man of quiet disposition with sweet but occasionally abrasive temperament, he possessed a devastating wit and a strong earthly common sense which he often exercised in his immediate congenial company. His sense of humour was indeed very delightfull. Whenever Sir Gerald was in the company of his close friends and associates, they knew that with a few exchanges he would come out with some illuminating witty sallies in which they did not know whether to appreciate the banter or the phraseologies more or probably both.

As an officer, he was kind hearted and believed in developing close rapport with his subordinates, many among whom he knew by their first names. He would often go out of his way to call on a retired Ranger Forest Officer or a Forest Guard. While serving at the Forest Research Institute, it was a familiar sight of "Trevor Sahib" riding on his beautiful and sturdy horse and visiting the residential areas of non-gazetted staff to inspect the sanitary conditions and other welfare activities. He never forgot to carry with him small but inexpensive gifts for the children of the staff. He was so popular among them that the mere sound of trotting of his horse would gather them. Simple and large hearted, "Trevor Sahib" always found himself at ease in their company.

However, he could hardly tolerate inefficiency, slackness and duplicity, but he recognised good and efficient work, and an honest endeavour which was always rewarded. His junior colleagues loved and respected him because of his rare qualities of head and heart. According to Mobbs who worked as his junior for several years "his long and wide experience tended to make him, on occassions, somewhat dogmatic, but to the end he was always ready to learn as also to teach". His hospitality and generosity became a legend during his life time and even after his death. An

evening with him always made one a more knowledgeable person, be it forestry, history of India and Wales, comparative theology, politics, modern economics, agriculture, sheep husbandry, horticulture, etc. Such was the wide horizon of knowledge of Sir Gerald who had been an avid seeker of knowledge even to the last days of his life. He was Foundation Fellow of the Indian National Science Academy (formerly National Institute of Sciences).

His memory at the New Forest campus has been perpetuated in naming a prominent road after him. Every auto-rikshaw and taxi-man knows the Trevor Road of the New Forest campus.

In 1912, he married Miss Enid Carroll Beadon who survived him. They had three daughters and six grand children.

Sir Gerald (Trevor) breathed his last on May 20, 1959 at the Victoria Memorial Hospital, Welshpool, where he was transferred after a surgery at the Maelor Hospital, Wrexham.

At the time of his death he was survived by his wife, three daughters, six grand children, a brother, Commander Ronald Trevor and a sister, Miss Mildred Trevor. He was laid to eternal rest at the Gualfiefield Parish Church with which he was intimately connected for many years. His last rites were attended by a large number of friends, pupils, former colleagues and a host of admirers.

### EPILOGUE

The very name of Sir (Charles) Gerald Trevor conjures up a panoramic vision of an outstanding administrator, a visionary forester, an accomplished teacher, a brilliant scientist, a thorough gentleman with impeccable manners, compassion, forgiveness, truth, and righteousness, a religious man, a devastating humourist and a much sought-after company. Against this background his dogmatism and abrasive behaviour took a much backward seat in the theatre of life.

**P K SEN-SARMA**

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W. A. Sherry

## **BHUPATI MOHAN SEN**

**(1888-1978)**

**Elected Fellow 1935**

### **EARLY LIFE AND EDUCATION**

**BHUPATI MOHAN SEN** was born on 1st March, 1888 in Rajshahi (now in Bangladesh). His father Raj Mohan Sen was Professor of Mathematics and Vice-Principal of Rajshahi Government College. His mother, Nishi Tara Devi, was a very devoted and pious lady. Sen had his early education in the Rajshahi Collegiate School and Rajshahi College. He passed his B.Sc. Examination from Presidency College, Calcutta in 1908, with triple Honours, first class in Mathematics, second class in Physics and second class in Chemistry. He obtained the M.Sc. degree of Calcutta University in 1910 occupying first position in the first class in Applied Mathematics. After taking his M.Sc. degree he went to Cambridge where he was a foundation scholar of King's College for the period 1911-1915. In 1912 he took up his M.A. degree of Cambridge University obtaining the distinction of being a Senior Wrangler with the mark of distinction in special subjects. In 1914 he won Smith's prize of the same University which is a very great academic distinction. Prior to him this prize was won by renowned scientists like Herschel, Kelvin, Tait, Stokes, Crystal, Todhunter, Clark Maxwell, Ball and others. He was the first Indian to win this prize. In 1915 he returned to India and entered into Indian Educational Service. From 1915 to 1921 he was Professor of Mathematics of Dacca Government College and was Professor of Mathematics of Dacca University from 1921-1923. After this he joined Presidency College, Calcutta as Professor of Mathematics and held this position from 1923-1930. During the period 1931-1933 he officiated as Principal of Presidency College and was confirmed in the post in 1934. He was Principal of the same College for the period 1934-42 and retired from Government Service in 1943. After retirement from Presidency College he was appointed Part-time Professor of Pure Mathematics, Calcutta University and held the same post till 1954 when he retired from University Service.

### **RESEARCH CONTRIBUTIONS**

Sen's research contributions may be classified in the following groups :

- (A) Differential Geometry
- (B) Hydrodynamics and
- (C) Modern Physics

His contributions under Group A deal mainly with deformation of surfaces. He discussed the distinction between the applicability and deformation of a surface and its bearing on the general theory of deformation. He showed that the partial differential equation of the Monge-Ampere type on which the deformation of surfaces is supposed to depend is a necessary but not a sufficient condition.

His contributions under Group B are concerned with waves in canals and basins.

Since 1930 he engaged himself with research in Modern Physics. In 1933 he published a paper entitled 'The Neutron in Quantum Mechanics' in the journal *Nature*. In 1944 he delivered his Presidential address at the Mathematics and Statistics section of the Indian Science Congress on the topic 'The Fundamental Equations of Quantum Mechanics'. In 1947 he published a booklet in which he advanced a new theory of light and matter, claiming that this new theory is logically complete and satisfies experimental requirements. The second edition of this booklet was published by Calcutta University in 1958. In the preface to the second edition he writes as follows :

"The reception to the booklet has not been enthusiastic nor that there was any fault or defect found in the main arguments. Requests for comments and criticism to Physicists and Scientific periodicals excited no response. In these circumstances all that I can do is to embody the results obtained and leave the matter to the judgement of posterity.

My three objections to the Einstein Principle  $W=h\nu$  which is the basis of modern physics are still unanswered. They are:

- (i) a divisible beam with an indivisible quantum of energy is a contradiction in terms.
- (ii) the theory that light behaves as a particle or a wave just to suit experimental needs introduces the supernatural in the domain of natural philosophy.
- (iii) the existence of the continuous spectrum implies infinite radiated energy.

These are logical defects and until they are answered modern physics can only be regarded as empirical, all its successes notwithstanding".

## HONOURS

Sen received many honours and was associated with various learned societies and associations. In 1935 he was elected Fellow of what is now known as Indian National Science Academy. He was elected President of the section of Mathematics and Statistics of the Indian Science Congress for its 31st session held at Delhi in 1944. He was President of the Indian Physical Society for the years 1934, 1935. He was

invited by the International Congress of Mathematicians at Amsterdam in 1954. Invitations were also received by him from the Seminars for Theoretical Physics in Aachen, Heidelberg, Cambridge and the University of London. A few years before his death he was honoured with the award of the title of 'Padmabibhusan'.

### **PERSONAL LIFE**

Sen married in 1917. His wife Mrs. Santa Sen, the third daughter of the illustrious Dr. Sir Nil Ratan Sircar, was a lady of great intelligence and strength of character. Mrs. Sen died in October 1980, about two years after the death of her husband. Prof. Sen is now survived by his two sons and a daughter.

### **QUALITIES**

Professor Sen was a man of quiet and undemonstrative nature which lent him a certain aspect of austerity. Those who had not the privilege of coming in close contact with him were invariably inclined to regard him as a serious-minded puritan. In fact, the core of his personality consisted of a complex of sincerity, intellectual vigour and honesty, sympathetic comprehension and modesty. Those who had the privilege of coming in close contact with him discovered in him an innate, though restrained sense of humour, a love of literature and philosophy, an appreciation of music and an understanding of the weakness of human nature. The present writer would like to mention some personal reminiscences here. The course of his future career has been to a great extent moulded by Prof. Sen. The writer wanted to take up Honours in English for his B.A. course but ultimately decided to take up Honours in Mathematics at Prof. Sen's advice. As already mentioned, Prof. Sen was a Professor in the Department of Pure Mathematics during the period 1945-1954. As the writer joined the Department of Pure Mathematics as a lecturer during this period he had the good fortune of working as a colleague of Prof. Sen.

A man of high moral standing and humanistic outlook, Prof. Sen's memory will be cherished by his friends, colleagues and students not only for his academic eminence but also for his devoted and conscientious services for the development of Science in our country.

### **ACKNOWLEDGEMENTS**

The present writer wishes to acknowledge with thanks the help rendered by Mr. Monishi Mohan Sen, I.C.S. (Retd.), the eldest son of Prof. Sen, in supplying me with some material for writing this biographical memoir. The writer wishes also to express his thanks to Prof. M. Mitra, Officiating Principal of Presidency College, Calcutta, for his help in securing a good photograph and a specimen signature of Prof. Sen from the college.

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P.B.Sarkar

## **PULIN BEHARI SARKAR**

**(1906-1983)**

**Elected Fellow 1946**

### **BIRTH & PARENTAGE**

**PULIN BEHARI SARKAR** was born on March 1, 1906 in an extremely poor family at a small village Nowla in the district of Dhaka, now in Bangladesh. His father, Gagan Behari Sarkar, a petty Tehsildar under a local Zamindar and his mother, Kadambini Debi, a religious-minded pious lady, had to face enormous hardship to maintain a big family with so meagre an income. Gagan Behari had five sons and five daughters and Dr. Pulin Behari Sarkar was the eldest of them. Two sons and two daughters died at an early age. Dr. Sarkar's father was a strict disciplinarian and was widely respected for his unquestionable integrity and strong personality. Education of children was not much thought of in those days, especially in the rural areas, by their parents. But Dr. Sarkar's father ceaselessly impressed upon his sons the imperative need of good education, especially for the poor, to stand up erect in life.

### **FORMATIVE INFLUENCE**

Dr. Sarkar had his primary education in a local school and then shifted to a Middle English school in a neighbouring village in 1915. He appeared in the M.E. Scholarship Examination in 1918 and stood first in the Dhaka Division with a margin of 100 marks over the second. He was awarded a scholarship of Rs. 4/-. This success attracted the immediate attention of the eminent physicist, Dr. Meghnad Saha, who hailed from an adjacent village and was also born in an equally poor family. The contact with Dr. Saha led to the development of a deep fraternal relationship between the two which lasted throughout their lives. In fact, the hard work and the dignified struggle of Dr. Saha's life were a source of inspiration and an ideal for the young Sarkar. The wise guidance from Dr. Saha played a significant role in moulding the character and personality of Dr. Sarkar especially in the formative period.

### **EDUCATION**

Dr. Sarkar next entered Shyama Prasad H.E. School at Simulia, a few miles away from his native place. In consideration of his merit he was provided free board and lodging in the school hostel and for the rest he had to depend upon his fabulous

scholarship of Rs. 4/-, as no assistance was available from home. In fact, he could not have even the most essential text books. He passed the matriculation examination from this school in 1923 securing more than 80% marks with distinction in four subjects.

In spite of stark poverty staring at his face, and fighting against all odds, Dr. Sarkar entered the Dhaka Intermediate College for his I.Sc. course. At this period he had to work as a residential tutor in the house of a lawyer at Dhaka. In 1925, he passed his I.Sc. examination standing ninth in the Dhaka Board. Next he joined the Chemistry Honours class in the Dhaka University. For this he had to make strenuous effort to meet his minimum requirements, often working as a private tutor to a number of students. But his hard work and privations ultimately led to success; he stood first in the first class in the B.Sc. Honours examination (1928). Next year he took his masters degree in applied chemistry with a dissertation on "Fats & Oils in Rohi Fish" under the guidance of Dr. J.K. Chowdhury. In M.Sc. also he occupied the coveted first position in the first class. In his University days, he came in close contact with many eminent professors and especially with Sir J.C. Ghosh and Prof. J.K. Chowdhury whose wise counsel and constant encouragement were of immense help in his study and research activity.

In 1930 he began his researches as a government research scholar but he had to leave it for a professor's post at the B.N. College, Patna in 1931, where he worked only for a year. He came back in 1932 to his research activities at Dhaka. With the prospect of future absorption in Jute Research Laboratories to be soon set up under the auspices of the Indian Central Jute Committee, Sir J.C. Ghosh advised him to take investigations in the chemistry of this golden fibre. His researches on the "Chemistry of Jute Lignin" fetched for him the D.Sc. degree in 1936.

### **PROFESSIONAL CAREER**

#### **Professional Career**

<i>Position</i>	<i>Place</i>	<i>Period</i>
1. Research Scholar	Dhaka University	1930-31
2. Professor of Chemistry	B.N. College, Patna	1931-32
3. Research Scholar	Dhaka University	1932-36
4. Professor of Chemistry	Vidyasagar College, Calcutta	1936-39
5. Sr. Research Chemist	J. T.R.L. Regent Park, Calcutta-40	1939-50
6. Director	-do-	1950-67

Wherever he worked, he received high appreciation for his sincere hard work. He made an indelible mark in every department he worked.

Sponsored by Indian Central Jute Committee Dr. Sarkar visited various important laboratories of U.S.A. and U.K. during the period June to December 1948.

Dr. Sarkar was awarded J.M. Das Gupta Memorial Medal in 1934 and Sri P.C. Roy 70th Birthday Memorial Medal in 1936, both by Indian Chemical Society in recognition of his valuable contribution to the knowledge of chemistry in the field of "Jute Lignin".

### MARRIAGE & FAMILY LIFE

Dr. Sarkar was married to Mrs. Kamla Sarkar in 1937. Throughout his life Dr. Sarkar was blessed with a quiet life of great harmony and order—largely due to his wife—which significantly promoted his scientific and professional pursuits. Fortunately all the three daughters of Dr. Sarkar are now successful professionals—with high academic careers. The eldest—Sunanda Nag, a M.A. of the University of Minnesota is a senior advertising executive while his second daughter Mandira Sinha Roy—a Ph.D. of London University in Geography is now teaching in England. The youngest, Gopa Sarkar De, a Ph.D. of the University of San Diego, U.S.A. is now a Research Scientist in Chevron Oil Company engaged in oil exploration. She lives in California with her husband.

### PERSONAL LIFE

A man of stern reality and of strict discipline he was a self-made man in its true sense; not compromising his principles under any circumstances and never yielding to pressure from whatever source it came. By his own life he demonstrated that honest labour is never lost and God helps those who help themselves.

Apart from his research contributions, Dr. Sarkar initiated himself in the writing of text-books. His book on "Organic Chemistry" soon became a bible to the undergraduate students all over India. He wanted that our students should have books from Indian authors and that too at a low cost.

He could not forget the extra-ordinary suffering in his student days for want of money and want of text-books. That is why he brought out books at a very cheap price. The longstanding sore he could perhaps heal up partly by establishing Book-banks in Ramakrishna Mission Institutions for needy and deserving students.

He was not only a hard task-master but he himself worked very hard. Throughout his life—from his days of research scholarship to the last position of a director

at J. T.R.L.—he worked often continuously for fourteen hours a day, with strictest regularity and discipline. Personal comfort, idle gossip and addiction to any intoxicant, even tea, were unknown in his dictionary.

The publication of his books brought enough money. But he led an austre and simple life. Following the example of Acharya Prafulla Chander he always used coarse simple clothes and never indulged in any luxury. Though seldom publicised, he gave a major part of his money—several lakhs of rupees—to the Ramakrishna Mission. His munificence does not end there. His life is a blaring example of un-selfishness. Out of his unbounded compassion he helped financially unnumerable students to complete their education and stand on their legs. The distress of students always touched a sensitive chord in his heart. Many a friend and relation also received from him enormous help and sympathy.

Excessive strain while writing a new book at the age of seventy four brought untold miseries to this saintly person. The painful symptoms in his brain led to loss of memory. After suffering for about four years, he breathed his last on March 23, 1983.

P.C. DAS GUPTA

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Ramayya.

# **SRINIVASA RAMANUJAM**

**(1925-1984)**

**Elected Fellow 1984**

## **BIRTH, EARLY LIFE & EDUCATION**

**DR. SRINIVASA RAMANUJAM** was born on 25th June, 1925 at Palayamkottai in Tirunelveli District of the then composite province of Madras. He came from a respectable family of distinguished intellectuals. His paternal grandfather, Sri T. Rajagopalachariar, was Vice-Principal and Professor in the Madras Law College, well-known for his lectures on Jurisprudence and Hindu Law. His maternal grandfather, Sri S. Ramanujam Iyengar, was a District & Sessions Judge in the erstwhile Madras Province. His father, Sri R. Srinivasachariar, was in the Madras P.W.D. and retired in 1959 after several years of distinguished service in the Kannada, Malayalam and Telugu regions of Madras Province. His paternal uncle, Sri R. T. Chari, I. C. S., was a distinguished member of the Indian Foreign Service but died prematurely in 1955 while on active service as Deputy High Commissioner for India in Pakistan. In view of this family background, it is not surprising that Dr. Ramanujam took to an intellectual and academic career.

Though born at Tirunelveli, Ramanujam had his early education in Madras City. His father, being in a job which entailed transfers all over the erstwhile composite Madras Province, was constrained to maintain an establishment at Madras. It was not customary, at that time, to put children to school early and Ramanujam, after having been given private tuitions at home joined, only for Standard V, the Pennathur Subrahmaniam High School at Mylapore, Madras, an institution which has had the honour of producing many a distinguished and famous sons of the nation in the course of its eighty years of existence. He completed his school education before he was 15 years of age and, as he had not attained the age for admission to University courses, had to remain at home for one full year. This proved a blessing in disguise, for Ramanujam put it to best use. Apart from learning shorthand and typewriting (which helped him in later life to take enormous and copious notes of his wide reading and research), he spent this one year most usefully in voracious reading. He developed the habit of reading any book which came into his hand, whatever its subject matter, science, fiction or philosophy—and thus developed a versatile and thorough knowledge of contemporary literature in history and the sciences.

Thus equipped, Ramanujam took second group (Physics, Chemistry and Natural Sciences) in the Intermediate class when he joined Presidency College, Madras in 1940, unlike his brothers whose choice was Mathematics or Economics. That was also the year in which the college celebrated its Centenary and Ramanujam as a fresher, contributed his mite in equipping the centenary exhibition in the Botany section of the celebrations. After finishing his Intermediate course, Ramanujam joined the Botany Honours course and graduated in 1945. Throughout his college career, he continued his earlier habit of wide and extensive reading, not solely related to his subject of college study. He did not confine himself to concentrating on his college syllabus with a view to achieve distinction or rank in the university examinations but devoted his efforts rather towards augmenting his fund of general knowledge in all branches of study.

### HIGHER EDUCATION & CAREER

Prof. Ramanujam did his B.Sc. (Hons) from Madras University with Botany and Zoology in 1945. He completed his Associateship of the Indian Agricultural Research Institute, New Delhi in Agricultural Botany with first rank. He went to Wisconsin in 1959 and did his M.S. (Genetics) with a GPA 4.00/4.00. He could not continue for a Doctorate course due to the illness of his father which compelled him to return to India. He did his PhD in Botany from Agra University much later.

This writer contacted Dr. S.S. Rajan, a close associate of Prof. S. Ramanujam since 1949, for some of the memories he had of Prof. Ramanujam as a young scientist. Dr. Rajan recalls that "when young Ramanujam entered the IARI in 1949, the Division of Genetics (then called Division of Botany) had no more than a dozen scientists on the staff. A student admitted to the Associateship programme was straight away seconded to a staff member who supervised his research programme generally as a part of the Division's activity. There was hardly any distinction between an enrolled student and a junior staff member. Young Ramanujam was seconded to Dr. B. P. Pal and was required to present a dissertation on the classificatory value of leaf epidermal hairs in *Triticum* species and wheat varieties. This association with Dr. Pal whose early researches in Cambridge, England on the genetical studies of continuous variation in segregating populations, perhaps, ante dates even the coining of the term "quantitative genetics", doubtless contributed towards Ramanujam's interest in this field, in which he was to make such outstanding contributions".

As a student, Ramanujam gave an account of his sharp intellect, voracious reading habit and a total devotion to his work. Years later when Dr. Rajan met Prof. J. F. Crow of the Wisconsin University, Madison, Wis., he remarked about Ramanujam who had taken his courses in Genetics at that University. "It was amazing how Ramanujam scored A-plus grades so effortlessly. I wish all my students were like him".

As a young scientist Ramanujam came under the influence of Dr. N. Parthasarathy. This association with Dr. Parthasarathy initially and later with Dr. A. B. Joshi, provided Ramanujam the necessary training in the field of practical agriculture. Though trained geneticists both, Dr. Parthasarathy and Dr. Joshi never let the agricultural or agronomic aspects lose their focus in crop breeding programmes. Dr. Rajan vividly remembers the numerous discussions which he had with young Ramanujam along with Dr. Joshi or Dr. Parthasarathy, planning numerous field experiments and research programmes, many of which did not get off the ground due to limitation of resources but must have imprinted on Ramanujam's mind to be manifest later when he was put in-charge of all India research programmes with much greater resource availability.

In the mid fifties Ramanujam was deputed on a Rockefeller fellowship award to the University of Wisconsin for his Masters Degree. His excellent performance that drew praise from Dr. Crow has already been referred to. But more than the performance at the examinations, it was also an exposure to an environment of explosive developments in basic genetic concepts that gave birth to the "Molecular genetics". The department of Genetics at the University of Wisconsin was one of the leading centres that initiated research in this field under the leadership of Dr. Lederberg. This exposure definitely contributed to the shaping of Ramanujam as an outstanding teacher. It was also at this time that Ramanujam initially shared and took over, from Dr. B. P. Pal the responsibility of editing the Indian Journal of Genetics and Plant Breeding. This is how Dr. Pal remembers him : "He was a very devoted, silent worker, who came to be recognised by every body as a very good scientist and teacher. While undergoing training for his Diploma, he had to sit for a number of examinations but he always came out with flying colours, scoring very high marks indeed.

At that time I was the Editor of the Indian Journal of Genetics and Plant Breeding and noting his talents in this direction, I persuaded him to become the Assistant Editor. After a few years, when owing to the large increase in my administrative duties I had to give up the editorship, he was elected as the Editor. Until the time of his death he gave freely of his time to ensure the maintenance of a high standard of the Journal.

In 1964 when I was a member of the Second Education Commission, I was asked to head the Task Force on Agricultural Education. In order to hold meetings of the Task Force and to prepare its report, I was empowered to select a suitable person to assist me in this important job. I naturally thought of Prof. S. Ramanujam and he came and worked with me for six months. The report which was eventually prepared with the assistance of Prof. Ramanujam was appreciated by the full Commission and resulted in some important recommendations relating to Agricultural Education."

Prof. Ramanujam served the Division of Genetics from 1951 to 1967 as Research Assistant, Asstt. Cytogeneticist and Geneticist. In between (1965-66) his services were utilized by the Govt. of India as Assistant Educational Advisor, Ministry of Education. He was Professor of Genetics for several years.

He formulated the prestigious All India Coordinated Research Project for Pulse Improvement and worked as the first All India Coordinator from 1965-80. In the capacity of Project Coordinator, Prof. Ramanujam guided and coordinated the work of a large number of multidisciplinary teams of scientists. The project resulted in increasing production of grain legumes in the country. The research efforts related to breeding high yielding genotypes and developing improved management packages so as to increase production of grain legumes, which form an important component of Indian diet. Since 1980 till his death he was Head, Division of Genetics, Indian Agricultural Research Institute, New Delhi, with the responsibility of supervising, guiding and coordinating the research of a very large number of scientists involved in improvement of several important crops such as wheat, rice, grain legumes, oilseeds, millets, etc., with particular emphasis on high yielding adaptive varieties.

Prof. Ramanujam participated, as an invited expert consultant, in several National and International Conferences and Symposia on various aspects of crop production problem.

Prof. Ramanujam was a great teacher. He taught Genetics and Plant Breeding to post-graduate students at M.Sc. and PhD level for over 25 years and guided over 20 students for their Ph.D. and 15 for their M.Sc. degrees. His students hold very high positions in various fields.

Prof. Ramanujam was involved in education and agricultural policy planning in India and abroad. He was Member-Secretary of the Task Force on Agricultural Education of the Education Commission of Govt. of India. He prepared the draft report of the Task Force which reviewed Agricultural Education in the country from primary school level to university level. He was Member of the Team of Experts sent to Sri Lanka by the Govt. of India to advise on increasing pulse production in that country. He served as convener of Task Force of Legumes set up by the National Commission of Agriculture, Govt. of India. He was invited by IAEA, FAO and International Crops Research Institute in several international workshops and consultant panels concerned with different aspects of increasing legumes production. His services were lent for the conductor survey, under the auspices of the FAO in Laos which he completed in June-July 1984.

Prof. Ramanujam served as a Member in the Academic Council, Extension Council and Board of Management of IARI. He had a very long stint as Editor of the Indian Journal of Genetics and Plant Breeding, the premier journal in the field.

He edited the journal for over two decades and produced the proceedings of a number of national and international symposia, including those of the Vth International Wheat Genetics Congress. He was Fellow of the Indian Society of Genetics and Plant Breeding. Late Prime Minister Smt. Indira Gandhi presented a memento to Prof. Ramanujam for his services to the Society. He was elected a Fellow of the Indian Academy of Sciences in 1983.

Prof. Ramanujam had very close association with eminent agricultural scientists like Dr. B.P. Pal, Dr. M.S. Swaminathan, Dr. A.B. Joshi, Dr. H.K. Jain and Dr. V.L. Chopra.

Dr. M.S. Swaminathan writes. "I came into contact with Prof. Ramanujam when he joined the Indian Agricultural Research Institute in 1948 as a postgraduate student. From the very beginning Prof. Ramanujam impressed everyone with his remarkable clarity of thought and expression as well as his analytical ability. It is these qualities which later led to his choice as the editor of the Indian Journal of Genetics and Plant Breeding. He succeeded Dr. B.P. Pal in this very important assignment. Through his single-minded devotion, he made the Indian Journal of Genetics and Plant Breeding one of the world's leading journals in this field. Prof. Ramanujam willingly gave his talent and time to assist professional societies.

As a professor, he was popular with scholars because of the brilliance of his lectures. Above all, he was a kind-hearted and helpful human being, always ready to promote worthwhile scientific causes. Indian Genetics owes much to him for promoting excellence in the reporting of research results and for training a large number of young scientists possessing a solid foundation in the basic principles of genetics and plant breeding".

Dr. H.K. Jain recalls his association with Prof. Ramanujam : "I had the privilege of knowing Professor S. Ramanujam as one of his colleagues in the Division of Genetics at I.A.R.I. for more than 15 years. This was a period when the division received wide recognition in the country for its work in the field of plant breeding and basic research in genetics. Some of these outstanding contributions were made by Prof. Ramanujam. I also recall him as perhaps the most outstanding teacher the Division has produced in many years. When the post graduate school of I.A.R.I. was established in 1958, it was men like Prof. Ramanujam who contributed enormously to the success of this experiment and he was responsible in no small way to the present prestige of the post graduate school especially in the field of plant breeding and genetics. I also recall him as an outstanding editor who brought the Indian Journal of Genetics and Plant Breeding to a much higher level of recognition both in India and abroad. Above all, Prof. Ramanujam was a very friendly person and he was a source of strength for many of his colleagues in the I.A.R.I."

## *Biographical Memoirs*

### PERSONALITY

Prof. Ramanujam, apart from his intellectual attainments, was very popular and had a lovable personality. He was tall and impressive. By disposition, he was amiable. He never gave way to temper and there was hardly any instance of his having quarrelled or fallen out with any one. He was reserved by temperament and made only very few staunch friends but these were firm and lasting friendships, based on mutual regard and affection. He was, however, always of a helpful attitude and extended his guidance and assistance to any one who approached him. His studious habits resulted in his not having much of extra-curricular or sports activities but he maintained good health throughout. He was very sincere and honest both in his work and in his dealings with his family members and outsiders. He had faith in his religion but was not a believer in ritualistic orthodoxy. To him the performance of his duties was the only true Yoga (योगः कर्मसु कौशलम्). He practised successfully the Gita precept "कर्मण्ये वाचिकारस्ते मा फलेषु कदाचन्".

### LAST DAYS

Death snatched Prof. Ramanujam away at a time he could have given many more years of valuable service to the scientific community and the nation. A malignant tumour was detected in the brain of Prof. Ramanujam on 20th July 1984, and after a major surgery on 27th July 1984, he showed steady improvement. Even during his convalescence, his friends and colleagues found him absorbed in scientific literature. Unfortunately, however, Prof. Ramanujam could survive only for a few more months and on 10th December 1984 at about 10.40 hrs, he passed away leaving behind his wife, Mrs. Sita Ramanujam, his son, Srinivas, and his three brothers.

O.P. GOVILA

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John Miles

# **JAMES PHILIP MILLS**

**(1890-1960)**

**Elected Fellow 1937**

## **BIRTH, EDUCATION AND SCHOLARSHIP**

**JAMES PHILIP MILLS**, the son of James Edward Mills was born in 1890. He was educated at Winchester and Corpus Christi College, Oxford, and entered in Indian Civil Services in 1913 and was posted to Assam. In 1916 he joined J.H. Hutton in Naga Hills. After a month or two at Kohima he took charge of Mokokchung subdivision in very difficult circumstances as the area was beginning to become unruly having been without an officer for six months or more owing to shortage of personnel during the war. His hobbies varied : ornithology, ethnography and gardening. He conducted a survey of birds and mammals for Bombay Natural History Society part of which was published in 1923.

Mills had a realisation that good administration and a satisfactory solution of many administrative problems could not be achieved without a thorough knowledge of the people and a real understanding of their way of thought. His humane and dedicated personality combined all the best qualities of a British administrator and an affectionate devotion for the Nagas. His monograph on Lhota Naga came out in 1922 and the Ao Nagas followed in 1926. He also published a series of articles in various scientific journals. He was made Honorary Director of Ethnography of Assam in 1930 and returned to Naga Hills and completed a monograph on the Rangma Nagas which was published in 1937. It was before this about 1935, that he was sent to Bengal Government to examine and recommend on the administration of Chittagong Hill Tracts in the course of which task he covered over 500 miles, mostly on foot. In a couple of months he submitted an admirable and exhaustive report on the mistakes that had been made in the past and the measures needed for the future.

In 1943, he was appointed Advisor to the Governor of Assam for Tribal Areas and States, a post which not only made his experience of the administration of the hill areas of Assam, but gave him an opportunity of learning much about tribes with which he would otherwise have never come into contact. In 1947 he was made C.S.I. and retired from India, and in 1948 he was appointed Reader in the School of Oriental and African Studies of the University of London. Among his activities at

School of Oriental and African Studies was a compilation of a bibliography of ethnographic matters relating to Assam, which has never been separately published but has proved very useful to other bibliographers. After his retirement from London to his house at Sydling St. Nicholas, near Dorchester he interested himself in local affairs, and in his garden, and continued, as he has been in Assam, a keen fisherman.

Mills married in 1930 Pamela Moira, daughter of J. Foster Vesey Fitzgerald and had two daughters from her.

"Mills made an admirable colleague in administration. Apart from his practical and intellectual ability, his never failing sense of humour, his wit and his good temper in trying circumstances made him an invaluable companion, particularly in Camp. When he was my sub-divisional officer at Mokokchung his periodic visits to my headquarters at Kohima were events to be looked forward to and he was beloved by his subordinates no less than by his colleagues, equally so by many friends of all stations in Assam. The world is poorer by his loss" Hutton (1960 : 90).

Yet {another close ally of J.P. Mills, C. Von Furer-Haimendorf evaluates Mills' personality and contribution to ethnography in the glowing terms :

"Equally productive and scholarly was J.P. Mills, who continued the series of monographs with three excellent books on the Lhota, Ao, and Rangma Nagas. It was my good fortune that I could spend several weeks in the company of that humane and dedicated man ..... his liking for the Nagas was infectious and from the moment I met him in London, I felt he would make every effort to smoothen my path in the Naga Hills district, of which he was then administrative head. He encouraged me to concentrate on Konayak Nagas, a tribe differing in appearance, culture and language from all the other Nagas under British administration..... Would Mills, knowing of my coming, have arranged for some sort of conveyance to bring me to Kohima? ..... My feet had hardly touched the ground when a small policeman ..... ran upto me. Saluting he handed me, and promised to look after my luggage ... .... the letter was from Mills, who apologised for not coming to meet me, but told me that a lorry would bring me and my luggage that very same morning to Kohima. Enclosed with this letter was a pass, an indispensable document when entering the Naga Hill District".

"Small wonder that a man responsible for the entire administration of a district of about 4,293 sq. miles with a population of more than 1,78,000 Nagas should not lack in work. Later I discovered that Mills, who combined the functions of nearly all the officers of an ordinary plain district, was personally accessible to every one of these 1,78,000 Nagas and that even quite trivial cases were brought before his court for settlement. (Hainmendorf : 1976; 4-5).

Ursala Graham Bower dedicates her travlogue Naga Path (1957) to Pam(ela) and Philip Mills acknowledging her gratitude and proximity to J.P. Mills. Her sojourn to Naga Land as a functionary of British Army unveiled many a hidden aspects of Mills' personality. She writes : "The administration of hill districts was a very personal matter; depending almost entirely upon the individual officer and his influence. It called for men with integrity, tact, infinite patience and real devotion to their often obstreperous changes. Speaking as one who has seen the process of government from a worm's eye view ..... I should like to pay tribute to the remarkably high standard attained. The district of Naga Hills in particular was fortunate in its officers, and such men, as Hutton, Mills and Pawsey it enjoyed a long period of just and sympathetic control to which Naga loyalty and cooperation in two wars are a tribute.

"Had the area (North Cachar Hills) only been under Naga Hills, the story might have been different. There the administration was of an extremely high standard and the tribal problems were studied and understood ..... unhappily North Cachar was tacked on to Silchar ..... Hardly did it enjoy such skilled handling as Naga Hills next door. The few periods when it did are spoken of this day as Golden Ages. It was one of these that Mr. Mills, then Deputy Commissioner, Silchar ..... realised what was wrong, the first officer to do so, and his discoveries and efforts to clean up the mess are recorded in a series of tour diaries. Clean up of a very great deal of it he did, and took immediate steps to deal with the economic problems ..... when terracing seemed a solution, several men tried it, but by then Mr. Mills had returned to Naga Hills as D.C. and North Cachar was sinking back to its old neglect. Our connection with H.Q. was not always close in the very early days ..... I found myself ..... with exactly thirty rupees to keep myself for six weeks. I did it, touring hard to the whole time and losing thirty five pounds in the process, but when I went to Shillong for Christmas, directly after, Mr. Mills, when he saw me, guessed what was wrong. I think, he wrote to "V" Force—I had not dared to complain, for as a woman, I was freak in the job, and I was always afraid that they would find an excuse to fire me ..... However, in the New Year they gave me a rise in pay and allowed me rations, a very great help, for things were growing scarce by then and the prices were soaring.

"I went on to say 'No' (to Colonial Tim about his proposal of marriage with Ursula Graham Bower) till we reached Shillong. There the Mills' family shook my resolution. Tim had been round to call on them and announce his intentions—they had the best friends I had in India—and they were delighted with him. They were all for having the wedding at once.

"Forty eight hours later, on July 7th we were married. Cake, Wine, Wedding-dress, reception—Mrs. Mills, by some unfathomed miracle, produced them all." (Bower : 1957; 200-235).

The foregoing description is aimed at giving an objective portrayal of Mills personality which is a pleasant blend of his humane nature, a friend of the people in distress, a scholar of repute—as no reference on North-East India in general and on the Nagas in particular fails to refer to his authoritative and scholarly works on the Naga tribe. His astute scholarship blended with a high acumen for administration will be a topic to be discussed in the pages to follow.

### CONTRIBUTION TO ETHNOGRAPHY

Closest to Mills was his most fervent admirer, his immediate boss, his preceptor and friend J.H. Hutton. A few extracts from his tour diary shed an enormous beam of light on Mills' portrait. Hutton starts his diary—"The following notes were taken in course of a tour made by Mr. J.P. Mills and myself to a part of Naga Hills which, as far as I know, has never been visited by a white man (*ibid* : 1). It was Yaktu on Yonghong that Mills, pointed out the obvious relation between the "ostrich feather" tatto pattern of the change and the conventional representation of a buffalo's, the horns having disappeared in the tatto pattern or run over on the shoulders, perhaps, leaving the curled ears and a prolonged nose". Thus Mills name has been referred as many as seven or eight times in Hutton's first tour undertaken in April 1923.

During the second tour undertaken in Oct.-Nov., 1923 Mills accompanied Hutton from 18th to 31st October but unhappily was prevented from accompanying him in November due to a poisoned foot. On Oct. 31st Hutton writes in his diary, "Mills' foot was very bad with sceptic leach bites, and it was doubtful whether he would be able to come or not. .... Mr. Mills being unable to walk, I left him in Mokokchung (Nov. 5, 1923)." The foregoing statements of Hutton show how painstakingly Mills took his task of observing Naga culture from a close quarter. His first monograph appeared on the Lhota Nagas in 1922. In its preface Mills states : "I have attempted in this monograph to give some account of the Lhota Nagas, whose dour attitude towards enquirers has caused them to be somewhat neglected in the past. Boasting no great knowledge of anthropology, I have avoided theories and confined myself to facts. During some three years residence at Makokchung as Assistant Commissioner I have had the considerable opportunity of becoming acquainted with the habits and customs of this tribe. Many individual members of which now are my personal friends." Mills perhaps excelled over others in taming the shrew.

Hutton unfolds the Lhota Nagas (Hutton : 1922; XI-XII) with the following laudatory remarks :

"I am happy in thinking that not only have Mr. Mills' efforts in investigating the customs and beliefs of the Lhota tribe succeeded in putting them on record while there was yet time, but they have also incidentally contributed not a little to revivify their

observance..... In one small and decaying village Mr. Mills found there had been no communal ceremonies for the last 20 years (due to the impact of American Baptist Mission). This study was a timely portrayal of the Lhota Nagas who were beginning to lose their distinctive features and were in danger of losing their ethnic identity being sandwiched between Christianity as thought by American Baptist Mission and Hinduism as practiced by Assamese or the Nepali settlers who are the neighbour of the Lhota Naga on the plains side. Mills took a keen interest in reviving the customs abandoned by the Lhota Nagas. Hutton (*ibid XII*) noted "The ceremonial life of the village (Lisio) has acquired fresh vigour, and I have some hope that the decay that has set in may be thereby staved off. For it cannot contribute to healthy life to be deprived entirely of all public and communal ceremonies, and to revive them may do good ..... how far it is due to Mr. Mills' interest in Lhota custom I do not know, but the non-Christian population of Okotso has certainly reformed, rebuilt its *morungs* (youth dormitories) and reinstated Oyansoa in its fullness.

The monograph opens up with a general introductory chapter dealing with origin and migration, appearance, dress, ornaments, weapons, and character. The next chapter deals with domestic life : the village; the "morung", the head-tree, the house, the contents, manufacturers, trades, loans, agriculture and the ceremonies connected with it—livestock, hunting, fishing, food, drinks, medicines, drugs, games, music, and daily life. The third chapter deals with law and customs : exogamy, polity, and village organisation; inheritance, adoption; settlement of disputes; oaths, friendships; war and head-hunting, slavery; and position of women. The fourth chapter deals with religion : deities and spirits; the soul and life after death; magic; religious officials; public ceremonies; individual ceremonies; ceremonies for illness, social "gennas" (taboos); birth; marriage, divorce, death and miscellaneous beliefs. The fifth chapter deals with folktales and songs and the next delves on language. The last and concluding part of the book consists of appendices on Lhota calender; human sacrifice and lastly a Naga Assamese glossary and an index make the book an envy for the contemporary ethnographers even the methodology and ethnographic style has gone through a sea of change.

Mill's next monumental monograph on the Ao Nagas was published in 1926 with a foreword written by Henery Balfour. Prior to his monograph on the Ao Nagas Surendra Nath Majumdar of Assam Medical Services published an article on the Ao Nagas in *Man in India* in 1924. William Carlson Smith, an American missionary also published a monograph entitled "The Ao Nagas Tribe of Assam : A study in Ethnology and Sociology in 1925 but the works of none of these authors could create ripples in the academic circles until Mills' The Ao Nagas came out in 1926 about which Henery Balfour surmises—"The present work by Mills in no way suffers from the fact the Ao having already been described by other writers. In each instance the point of view is different, and it is, indeed, a matter of interest to compare the

impression of these Nagas arrived at independently by an American missionary, a Hindu Medical Officer and an English resident official of the Assam Government." Highlighting the qualities of the monograph Balfour felt : "Ethnologist in particular will be grateful to Mr. Mills for his careful and exhaustive study on one of the important and well defined tribes in the Naga Hills. The volume well maintains the high standard of excellence set by Dr. Hutton..... The growing series of tribal monographs issued under governments' auspices will be standard works of reference, valuable not only as a record of the indigenous native customs, beliefs and ideals, but also as a means understanding and of evaluating the status and potentialities of these "unseen" peoples, a prime factor in promoting and facilitating an enlightened, sympathetic, and just administration."

Writing an introduction on Smith's monograph on the Ao Nagas, Hutton (1925 : IX) refers to the forthcoming monograph of J.P. Mills on the same tribe in the following words. "A most exhaustive and authoritative account of the tribe by Mr. J.P. Mills is just nearing completion..... it is to Mr. Mills' work that we shall ultimately turn for a detailed account of the customs and beliefs of the Ao tribes." Writing preface to the second Edition of Mills' Ao Nagas published in 1973, Hutton (1973 : XIV) observes : "Many changes have taken place since J.P. Mills retired in 1947 and even more perhaps since his untimely death. Change is inevitable in all human institutions, but there must still be Aos living who can remember something the simple and kindly form which civil administration took when he (Mills) was Subdivisional Officer of Mokokchung, and the account he has given us of the Aos is evidence of interest he took in them and in his work".

The content format of the Ao Nagas does not differ significantly from his earlier monograph on the Lhota Nagas. The book has been divided into six parts : the first part consists of an introduction, the second deals with domestic life, the third with law and customs; the fourth with religion, the fifth with folk tales and songs and the sixth and last part with the languages. Six appendices discuss the ceremonial details of the Feast of Merit, mensuration, administration; effects of missionary work among the Aos; village names and lastly a bibliography of the Naga Hills and adjacent areas.

The book was reviewed by F.J. Richards in 1927 (*Man*, XXVII; 74-75) in the following words— "Mr. Mills book is an important contribution to the study of that puzzling culture complex which separates India from China.

"Of the daily life of the Aos, their religion, their "feasts of merit" and their folk tales Mr. Mills gives full details. His account is enlivened with the kindly humour of one who understands and values his friends. He warmly defends them against their detractors who dub them sulky, quarrelsome and cowardly, and, naturally, he deplores their deculturation under missionary influence, a theme which

Prof. W.C. Smith, in his book on the Ao, has pressed so strongly, Mr. Mills gives point to the Professors warning by concrete facts, and his apprehensions are endorsed by M.H. Balfour in the useful preface which he contributes. Fortunately the Assam Government are alive to the importance of studying the culture of the folks whose destinies they hold in trust. It is impossible to overrate the administrative value of these Assam monographs and it is a pity that no other administration in British India has followed the Assam lead..... Mr. Mills is to be congratulated for a very thorough piece of work."

The last in series of Mills' trilogy was *The Rangma Naga* published in 1937 by Macmillan more or less on the similar lines of that of two earlier monographs on the Aos and the Lhota Nagas.

Mills has also coedited a collection of essays presented to Rai Bahadur Sarat Chand Das, entitled *Essay in Anthropology*, with B.S. Guha, K.P. Chattopadhyaya, D.N. Majumdar and A. Aiyapan. The book has been published by Maxwell Company, Lucknow. The year of publication is not discernible. Mills has contributed three articles in the book voicing his concern over—(i) the introduction of potato in the North-East; (ii) Widespread of Christianity; and lastly (iii) the establishment of Shillong as a State Capital of Assam and the related problems with regard to property, changes in customary laws and the new trends of adjustments between patriarchy and matriarchy.

Besides monographs Mills has an edited volume to his credit. He contributed 38 papers and in two papers he was a co-author with J.H. Hutton and Haimendorf. This list may not be treated as final in view of the paucity of material on J.P. Mills in India.

1922 was a curtain raiser for his scholarly monograph on the Lhota Nagas. In 1923 there came a published report on the Mammals Survey of India Burma and Cylon. He also published a review article entitled "The Lesson of the Red Man" on G.E.E. Lindquist's book on the Red Man in the United States. Through this review article he propounded his basic philosophy about the quality and direction of change occurring in tribal societies. "It is significant", tells Mills (1923 : 117), "that the book.....describe the present state of the scattered remnants of those once mighty tribe, so uniform has been their treatment and its results. The story is a harrowing one and not without interest to ethnologists in India, where in many places the unregulated introduction of alien culture threatens to destroy in a generation the social organisation which the primitive tribes have built upon the foundation of age old experience. The dealings of white men with Red Indians fall into three periods : extermination, segregation and assimilation—segregation begins with forcible removal of Indians from their homes and their settlement in Reservations to fend for themselves —the system of Reservations failed ..... the Indians lost all ambition and interest in

life—not being sufficiently protected from the vices and diseases of the White man..... it was therefore decided to absorb the Indian into the ordinary population of United States, and the present period of Assimilation began..... There is no longer room for Indian to live as an Indian ..... the Red Man's superstitions, which no fewer than 27 different denominations are attempting to eradicate; no marriage by Indian custom is "legal" tribal dances are "injurious to industry" ..... no Indian is granted the right of citizenship unless he breaks away from his tribal organisation.... In any case they must soon cease to be Indian in anything but blood. Individuals will doubtless flourish and grow rich but the Man as a nation, can never hope to contribute anything to the world ..... In places such as Assam primitive hill tribes are living life which centuries of experience have shown to be the best suited to their environment ..... some of them are unlucky enough to live where coal and iron are found, and there is a risk that the land which now grows rice may sometime be taken to produce dividends for shareholders. If the demands of commercial progress are too imperious to be denied, the tribesmen should, if possible, be given suitable lands near in the few places where it is available and mistakes of Reservation policy of the United States be avoided ..... the land must be near to plant a village or a tribe on the land of a distant alien tribe is to court disaster.....Under the pretext of "civilizing influences" certain organisations are pursuing towards the hill tribes a policy of denationalisation and assimilation very similar to that which is being carried out towards the Red Man in the United States.

"Range upon range of glorious hills will stand forever as they stand today. Shall they hold nothing but a few remnants of the tribes, their own well tested culture gone and their new way helplessly ill-adapted to their stern home, or shall they hold a proud and vigorous people with a culture modified perhaps, but based on the old foundations which have stood the test of time so well, a race well fitted in the years to come to add a not inglorious page to History? The choice lies with us today."

1926 may be termed as the most academically productive year for J.P. Mills wherein he came out not only with a highly authoritative monograph on Ao Nagas, which won him a world-wide acclaim, but also with three papers. The February issue of Sphere comes out with a paper entitled, 'Among the Head-hunters of the Naga Hills'; the April issue of Geographic Journal published an article on tribal situation in "The Assam Burma Frontier", the Methodist Church Magazine in its May issue bring yet another article on head-hunting entitled, "Among the Head Hunters of Assam". Lastly, the Journal of Asiatic Society of Bengal (Vol XI, XII, No. 5) came out with a collection of "Folk Stories in Lhota Nagas". His meticulous and rigorous methodology may serve as a model for the ethnographers of today. In his own words, "while working on Lhota Nagas, I realised how scanty had been the attention hitherto paid to their language.....and I determined to attempt to combine with a record of their folk-lore a record of the language as actually spoken.....my

method was.....: some Lhota.....would offer to tell a story. We would listen to him. Then I would, cause Tsano to take it down word by word..... the story was then read over carefully several times to the teller to make sure that his version has been accurately recorded. The next stage was to read it over to two or three old men and obtain their confirmation that the story had been told in a manner which accorded strictly with sound tradition. The folklore having been voted accurate we turned our attention to language and spelling. I had each sentence pronounced very slowly and distinctly and rewrote it with care. Then I made sure that had cut it up into words properly .....I had a small word list in which every word was entered, and against which every word was checked at each recurrence to ensure that the spelling was kept consistent. On a fair copy of each story an interliner word for word translation was added. Finally a running translation was made." 29 stories were thus collected in this article which not only show the structure of the language as actually spoken with its long and characteristic participle clauses, but all facts have also been assiduously preserved.

Two articles appeared in 1927: the April issue of Country Life featured, "Among the Headhunters of Assam"; and "Certain Aspect of Naga Culture" were discussed in Journal of Royal Anthropological Institute (Vol. XVI).

The year 1928 appears to be academically lean wherein there appears only one article in Assam Review on the "Hill Tribes of Assam". This was the period when Mills proceeded on a long leave.

In 1929 Mills published an article with J.H. Hutton on the Ancient Monoliths of North Cachar." He was then acting as Deputy Commissioner, North Cachar. "No previous records of the discovery of these stones appears to exist at all ..... Since our visit the foremost important groups have been gazetted as ancient monuments." (Mills and Hutton 1929, 286).

After 5 years of a lull (1926-1931) Mills came out with a series of notes in census publications and reports submitted to the Government of Assam in capacity of Honorary Director of Ethnography, Assam. His two reports consist a note on Gaidiline Monument (June, 1) and the other submitted to the Commissioner, Hill Division (June, 24).

In Census of Indian, 1931, he submitted a "Note on Effects of some primitive tribes of Assam on contact with civilisation. The tribes included under the foregoing notes are : Rangma Naga, the Baite and Kholma Kukis of North Cachar Hills. In one of the notes on the effect on the tribes of the Naga Hills district of contacts with civilization, Mills reiterates :

"Times are changing and new influences and tendencies are appearing. Tribes and villagers acting as units will be able to judge of them and resist them if necessary. Individuals will find them too strong. Will the time come when these hills will be

inhabited by scattered families, without pride in the past and hope for the future, without arts and without recreation, dressed in non-descript garments and drab as their own lives, and busy to win from the steep, rocky slopes enough sustenance to enable them to beget children and die?" (Mills, 1932 : IV). In 1934 Mills contributed an article, "The effect of Ritual upon Industries and Arts in Naga Hills" to the International Congress of Anthropological and Ethnological Sciences, London. The article starts with the following remarks, "It was a very hot March day in a village of Ao Naga tribe on the South-east frontier of Assam that I received a letter from the President of this section, asking me if I would speak briefly on the inter-relationship of the economical industrial and artistic life of the Naga tribe.... My inclination was to decline the honour but he is an old friend and knows my limitation. I am no scholar with a library at my elbow but an official incharge of a remote area, who can only tell you something of what I have seen every day during many years I have spent in Nagaland. The paper deals with: (i) agriculture and connected ceremonies; (ii) other industries; (iii) Feasts of Merit and the stimulus they exert; (iv) head-hunting and its effects on decorative art and lastly; (v) disasterous effects of belief regarding fires and unnatural deaths (1935 : 144).

In 1935, Hutton edited the Ethnographic part of Census of India 1931 report (Hutton : 1935;118-149) wherein Mills contributed ethnographic notes of Magh, Chakura, Tippera, Khoyangs, Kukis, The Mros/Mrungs, which he studied during a course of his tour to Chittagong Hill Tracts in 1926.

The July issue of Geographical Magazine had published yet another article of J.P. Mills entitled, *Sanctuary of Savages*.

"The Rangma Naga—A Split Tribe" was yet another communication presented to The Royal Anthropological Institute and published in volume XXXV of *Man*.

"The Naga Head Hunters of Assam" was published in Royal Central Asian Journal (XXII : 418-22). In 1936 C. Von Furer-Haimendorf joined hands with Mills to write "Sacred Founder's King among the Angami Nagas", published in *Anthropos* (Vol. XXXI). Another article in the name of J.P. Mills appeared in the journal of Indian Anthropological Institute under the title "A Lhota Naga Apotia' Death in 1938 "Mishmis of Lohit Valley, Assam" was his Presidential Address to Royal Anthropological Institute published in the Institute's Journal in the same year.

The foregoing description suggests the impact that Mills made on the academic circles of the British India and Great Britain. His stay in India spanning well over three decades was characterised with his complete commitment of his most favourite 'hobby' anthropology and to his duties as an administrator. By the time Mills returned to England he came to be considered as an erudite scholar and a successful administrator his stint of administration in Nagaland Hill Districts was referred as a 'golden age' by his contemporaries.

## THE ADMINISTRATOR

Haimendorf (1976:2-43) provides some first hand glimpses into the Mills' style of administration :

"Small wonder than a man responsible for the entire administration of a district of about 4,293 square miles with a population of more than 1,78,000 Nagas should not lack in work. Later I discovered that Mills who combined the functions of nearly all the officers of an ordinary plain district, was personally accessible to every one of these 1,78,000 Nagas and that even quite trivial cases were brought before his court for settlement". During a sojourn to Angami Naga villages Haimendorf accompanied Mills and provides a vivid description of his travel : "about thirty people had come to welcome Mills.....During the next few days Mills was mainly occupied in counting the houses of several villages for the assessment of taxes. The Angami paid in place of land revenue an annual house tax of three rupees; old and sick people being granted exemption.....Crowds of men and boys followed Mills from house to house, and the women peeped shyly and curiously out of their doors. It is not an easy job to count the two or three hundred houses of a large village and at the same time to check all the statements of the *gaonburas* (village headmen) to poverty and inability to pay on the part of individual villagers. Even the purely exertion is considerable". Scarcely had we arrived in the banglow when a tremendous noise arose. There were several cases to be brought before Mills, and the quarrelling parties had each brought hordes of clansmen and friends to support them.....(which they) thought best to render in loud altercation and expression of opinion. The cork was out of bottle, and all the anger that has been suppressed for months seemed to explode at the long expected visit of the "Great Sahib".....another interpreter, acting as examining magistrate, had the case explained to them beforehand, but it was as much as they could do to keep the quarrelling parties in hand to claim their shouts and those of their followers. Most of the quarrels were about land or succession of property, or the claims of a betrayed husband, seeing the seducer of his wife, or the damage that one man's cattle has done to another man's crop. Very patiently he worked through the tangles of accusations and defense, and finally passed judgement.

"The relations between the independent chiefs beyond the border and the officials of the neighbouring Naga Hill District were of a rather curious kind, depending more or less on the personality of the Deputy Commissioner himself. Without in anyway giving up their sovereignty in their own territory, the autocratic village chiefs sometimes invite "Great Sahib", as they call the Deputy Commissioner to act as a mediator in settling their long drawn out tribal feuds. Mills, who for years had been Sub-divisional Officer at Mokokchung,.....knew most of the chiefs beyond the frontier personally, and he possessed considerable influence and authority among them. But when the Nagas from across the frontier raided villages in the British

territory the Deputy Commissioner no longer acted merely as a mediator. He usually called the offender to account, and even undertook punitive expeditions against unruly villages when he considered it necessary. However such actions were extremely rare, for the chiefs usually knew just how far they could go."

The famous Pongsha Expedition launched in 1935-36 by Mills to punish the head-hunters and abductors of a young slave girl has been vividly described by Haimendorf (*op. cit.*). Barch (1970, 49) gives the following account of the said punitive expedition :

"Great havocs ensued in 1935 owing to a Kalyo Kenyu Naga raid by Pangsa. An expedition under J.P. Mills set off from Mokokchung in Nov. 1936 and advanced ..... but at Moklak the Pangsa messengers came to welcome, yet they refused to deliver the slaves whom they had captured.

It is after Pangsa was burned that the parleys for peace were opened. The fine were paid and the slaves taken off were delivered.....it was 1938-39 that Pangsa was also taken by the administration.

The contemporaries of Mills are unanimous in their opinion that the "Great Sahib", as the Nagas of the administered territory or even beyond, would refer Mills, ushered a "golden age" of administration in Nagaland. He is still remembered in Kohima, and Shillong as an officer with a commitment, with an infectious love' for the people he ruled, an extremely humane and helpful companion to his friends, an ideal host, a trumble shooter', and a virtual custodian of the people he administered.

### A CRITICAL APPRAISAL

The Naga might have looked at J.P. Mills as their Messiah but he has come under sharp attack from the historio-sociological school of Indian scholars.

The first salvo was shot by G.S. Ghurye (1980-11-13) whose actual target is Verrir Elwin but Mills too was hit by splinters in the process. Quoting an extract on Mills' view on the Naga head hunting (Census of India 1931, Appendix A, Part III, Assam, p-11), Ghurye (*op. cit*) remarks "How callous on purpose.....Under the circumstances one wonders why he (Elwin) should have introduced that quotation from a work that had been published full quarter of a century before the publication of the expounding of his philosophy for his rule over the region.....Dr. J.H. Hutton .....makes no mention of head-hunting in his description of their culture (Hutton, 1929:9) so dead and forgotten it must have been in 1929 ! From Dr. Hutton's note on the head-hunting.....contradicts Mills' dictum that the practice mostly affected the Nagas only.....the people most likely to be affected were members of tribes other than Nagas.....That inspite of all this Dr. Elwin should not only quote a thoroughly

propagandist note of Mills published a quarter of century ago." The nutshell of Ghurye's viewpoint is that Indian tribal population are a part of Hindu population. Efforts, therefore, should be made to assimilate them with the larger Hindu population of India. He blamed anthropologist to put forward the idea of isolating tribal population on the pretext of preserving their cultural traditions.

Jagannath Patty (1981:623) sees the "origin" of anthropology in "Colonial milieu".....meant to meet the political and administrative problems which the colonial and later imperial forces forced in the process of expansion and consolidation of domains.....With the rise of national movements in the colonies and the consequent disintegration of colonial rule new form of imperialist domination have come into being. It is imperative for this imperialism to subvert and co-opt the raising anti-imperialist forces in the third world countries. In this endeavour too anthropology, specifically anthropology of development as it is perceived today, provided the necessary academic and intellectual support."

K.S. Singh (1984: 399-412) partly supports Patty's above proposition while analysing vividly the roles played by Mills and Hutton who "sought to influence the political opinion in London in favour of their proposal regarding complete exclusion of tribal area from the operation of constitutional reforms so as to keep the tribals under the direct control of British administration.....the Govt. of India restricted the number of excluded areas to four and that of partially excluded areas to eleven tracts.....at this stage some conservative back benchers led by Codogan and James revolted and pressed, probably instigated by anthropologists..for enlargement of the list of excluded and partially excluded area and for a larger measure of protection for the tribals.

"Both Mills and Hutton were at that time in London. Mills was on leave.....he found time to keep in touch with the constitutional development.....Both the excluded and partially excluded areas were extended by 300 to 400 per cent.....the nationalist opinion saw in the new constitutional provision for partially or fully excluded areas the familiar imperialist design to separate and weaken the national unity and undermine the freedom struggle ....The nationalists reacted sharply to the attempt to isolate the tribals from the mainstream. The isolationist school of policy makers comprised 'anthropologists and the British members of Indian Civil Services of which G.H. Hutton was the arch opponent" (*ibid.* 406-407).

Any objective observer to the North-East Indian situation may easily derive a conclusion that the tribal population there had been purposely kept in isolation—away from the concept of Indianness and Indian nationhood. The Nagas and Ahoms, on one hand and the Bengalis emigrants on the other hand have passed through a cycle of hostilities. The British administrators failed to integrate the people under their rule with the rest of the Indian population. This resulted in developing a

demand for an independent nationhood for the Nagas. Mills and Hutton were a party to portray the Nagas as an independent entity beyond the gamut of Indian nationhood.

Mills, it seems, had a dual personality—an anthropologist and an administrator. He excelled his contemporaries in the former but could not do so well in the latter partly owing to the compulsions of the colonial objectives of his government and partly due to his scholarly bent of mind. But Nagaland still remembers him as their "Great Sahib" and the period of his stay there as the "golden age".

Mills, in short, led a meaningful life and his services were duly recognised not only by the British Government but also by the professional association.

The Asiatic Society of Bengal conferred on him their non-resident membership as early as 1st Feb. 1926. His name was proposed by H.E. Stapleton and seconded by J.D. Tyson. Mills contemporaries in Anthropological section of Asiatic Society were J. Cunningham, M.D., Lt. Col. I.N.S. Harris, Director, Martin S Harris, Pasteur Institute; J.H. Hutton; D.P. Khaitan, M.L.C., Attorney-at-Law; P.C. Mahalonobis, Father A.H. Francke and Rev. P.O. Boding—the author of *Santal Folk Tales (Memoire, Asiatic Society of Bengal, 11(1))*.

He was made a C.I.E. in 1941 and in 1942 he was awarded River Memorial Medal of the Royal Anthropological Institute for field work among the Nagas of Assam; in 1947 he was made C.S.I. He was elected to the Council of Royal Anthropological Institute in 1948 and was subsequently elected as their President for the term 1951-53. It is further on record that Mills contributed towards the housing fund of the Royal Anthropological Institute. The Pitt-River Museum of the University of Oxford will remain grateful to Mills for important collection of specimen he donated to the Museum.

B. R. RIZVI

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# **SARANGAPANI PARTHASARATHY**

**(1904-1962)**

**Elected Fellow 1952**

The scientific era laid down by Sir C.V. Raman in the early 20th century had produced a chain of stalwarts in Science in India especially in Physics. The most notable amongst them belonging to this nucleus had been Dr. K.R. Ramanathan, Sir K.S. Krishnan, Dr. Mata Prasad, Dr. S. Bhagwantam and Dr. S. Parthasarathy. Every one of them had been innovative in his own field of specialisation of which he can be called the pillar. Dr. S. Parthasarathy had the rare distinction of creating a national base for ultrasonic studies and research in the country, a work started in 1935 at the Institute of Science, Bangalore and established at the National Physical Laboratory, New Delhi.

## **EARLY LIFE AND EDUCATIONAL CAREER**

Dr. S. Parthasarathy was born on March 15, 1904 in a Tamil speaking middle class brahmin family. His father, Mr. Srinivas Iyengar, belonged to Madurai in Tamil Nadu, India. Sarangpani had his early education in Madurai and Madras but for his higher education he had gone to the Royal Institute of Science, Bombay, one of the well known institutes of his time. From here he passed his B.Sc. in First Class Honours with First Rank in the University of Bombay. For his studies he had chemistry as the principal subject and physics as the subsidiary subject. Young Sarangapani was greatly influenced by the scientific luminaries of the time like Sir C.V. Raman and Albert Einstein who attracted his attention and influenced him.

Soon after his B.Sc. he joined service as Professor of Physics at Fergusson College, Poona, however, his remarkably brilliant academic career and his thirst for higher studies could not hold him long on the job and during the year 1930-31 he joined the Bombay University for his doctoral work in Physics. He did his doctoral work at the Indian Association for the Cultivation of Science, Calcutta with the help and facilities provided by Sir C V. Raman during the years 1931 & 1932 and on a thesis submitted on the subject of 'Scattering of Light' to the Bombay University, in 1934 he was awarded the degree of D.Sc. in Physics. His contributions were so distinct and outstanding that he was awarded the Moos Medal

for his D.Sc. by the Bombay University. Moos Medal was a rare honour of that time which used to be awarded only to persons of the highest distinction in Science. This resulted in his name being engraved on the "Roll of Honour" (academic) in the Royal Institute of Science.

### **MARRIAGE, WIFE, CHILDREN AND REMINISCENCES OF PERSONAL LIFE**

Dr. S. Parthasarathy was married twice. His second wife had been the daughter of an Advocate Sampat Iyengar, a leading lawyer of Madras, who was also the official legal advisor of the Mudaliar family. She gave birth to his only son named Satyamurthy. He was very fond of his son and gave him very good education.

Dr. S. Parthasarathy had been a soft spoken person throughout his life but he had been very strong of his opinions. He had travelled extensively in India and abroad and many top luminaries of his time working in the field of ultrasonics were in the list of his friendship. He had great regard and admiration for them who too had great regard and admiration for his scientific contributions in the field of ultrasonics.

He had been a very hard-working, honest and intelligent person. He had a pleasant and lovable personality. He used to keep very cordial relations with all his associates (including the junior most) who worked with him. They had free access to him and he had also great faith in them. He used to go out of his way for their welfare. His interest in research was immense and continued till the date of his expiry (16-1-1962). From his sick bed even, he kept on guiding his associates who used to visit him daily in the evenings.

He used to wear a black cap on his head which he had abandoned in the later part of his life when he started using a felt hat. In the black cap which used to be so much distinctive, he can be spotted easily in the two group photographs of the ultrasonic luminaries of the time published in the Jubilee Issue (Sept. 1954) of the Journal of the Acoustical Society of America. He liked the South Indian dishes — Masala Dosa and Coffee which he used to relish daily in the evenings. He was a strict vegetarian, non-smoker and teetotaller.

Dr. S. Parthasarathy attracted a band of talented workers from all over the country who joined with him on his research programme in ultrasonics at the National Physical Laboratory. Many of his associates namely R.R. Aggarwal, V. Narasimhan, M. Pancholy, A.F. Chhapgar, C.B. Tipnis and S.S. Mathur were awarded doctoral degrees by Indian Universities on the basis of the work conducted under his guidance while many others in his team namely D. Srinivasan, S.S. Chari, P.P. Mahendroo,

Har Krishan Singh, D.S. Guruswami and A.P. Deshmukh were recommended to go abroad on fellowships awarded by universities and Institutes in the United States of America from where many of them returned with doctoral degrees. Nearly all his associates have worked abroad in various ultrasonic laboratories on one programme or the other.

During the last few years of his life he was suffering from diabetes which started weakening him and as a result he started to be a little irritant in nature as also he started confining himself to his own group. He had a feeling of frustration in him which used to be very evident in his day-to-day behaviour.

Dr. Parthasarathy's scientific achievements were well known to all his contemporaries. His work has been reviewed in many books and journals. In the following are reproduced some of the extracts from the reviews about the scientific work of Dr. S. Parthasarathy which express in themselves the scientific personality of Dr. S. Parthasarathy.

(1) Prof. Brillouin had written in a letter dated July 10, 1936

"I just received yesterday your letter and your paper on diffraction of light by ultrasonic waves, which I read with great interest. I am very glad of your results and I congratulate you for realising for the first time this very brilliant experiment.

"In your experiment, you work with very high ultrasonic intensities and light rays of various incidences; for this case, there is until now no complete theory, and the only available prediction is the formula

which you verify in a very brilliant way."

(2) Prof. P. Vigoreux in his book on "Ultrasonics" has written about Dr. S. Parthasarathy's work :

"There are many records of measurement of velocity of ultrasound in organic liquids, possibly the longest list is due to Parthasarathy".

(3) Prof. A.B. Wood has written in "A Text Book of Sound" :

"In this connection the work of S. Parthasarathy is noteworthy..... These and other relationships between chemical constitution and sound velocity derived by Parthasarathy provided much fundamental data for speculation on the molecular constitution of liquids".

(4) Bergmann in his celebrated book "Der Ultraschall" has written :  
 "...and a measurable reflection of the light in the Bragg sense becomes possible. Experiments of this sort with sound waves of length 0.065 and 0.05 mm were made by Parthasarathy who got for certain angles of incidence intensified diffraction spectra in the direction required by the Bragg rotation".

(5) Nature (January 16, 1954) while reviewing Dr. Pathasarathy's work on the "Equivalence of Sonic and Thermal Energies" has written :  
 "Dr. S. Parthasarathy and his colleagues at the National Physical Laboratory, New Delhi have recently published a series of papers on the equivalence of ultrasonic and thermal energies in a liquid..... From pairs of results, values of the mechanical equivalent of heat are deduced. The average works out at 4.19 Joules/Cal. to  $\pm 3\frac{1}{2}$  per cent."

### **PROFESSIONAL CAREER**

The first appointment of young Sarangapani after acquiring his graduation was as Assistant Lecturer (acting) in Physical Chemistry at the Royal Institute of Science, Bombay. Later he was appointed Professor of Physics at the Fergusson College, Poona. With the award of Nobel Laurette to Sir C.V. Raman in 1928 the atmosphere in the country became research oriented and many young talented persons were being attracted to carry out their researches on Raman Effect. Young brilliant Sarangapani could not resist the temptation to carry out research work on Raman Effect and registered himself in 1930 for research in Physics at the Royal Institute of Science, Bombay University, Bombay.

After obtaining D.Sc. in Physics in 1934, Dr. S. Parthasarathy joined the Physics Department at the Indian Institute of Science, Bangalore. Sir C.V. Raman was already here as Professor of Physics. Under the guidance of Sir C.V. Raman he was the first scientist in India to start and initiate researches in the field of Ultrasonics. Herein he used his extensive knowledge in various other branches of Physics and in Chemistry and achieved an intensive specialisation in the subject. In 1938 Dr. S. Parthasarathy was appointed Professor of Physics (acting) at the University College Rangoon in Class I Service of the Govt. of India.

In 1940 Dr. S. Parthasarathy was appointed Technical Secretary to the newly formed Board of Scientific & Industrial Research, Govt. of India. The Board was located in those days at the Government Test House, Alipore, Calcutta. Dr. Parthasarathy's extraordinary interest and zeal in ultrasonic researches dragged him to work at the Palit Laboratories of Physics, Calcutta University under the supervision of Prof. M.N. Saha. Here he worked for two years when he was transferred to the newly started laboratories of the Board of Scientific & Industrial Research at Delhi

University, Delhi which were lying partly unoccupied at that time. Most of the activities of the laboratories at that time were to assist the war efforts and therefore, Dr. Parthasarathy was directed to undertake industrial problems. He did pioneering work and initiated a number of industrial problems.

Dr. Parthasarathy was the first and the only Technical Secretary to the Board of Scientific and Industrial Research and remained in that position for five years. He carried out fully the technical and administrative work of the Board of Scientific and Industrial Research for complete one year in 1944-45 when Sir S.S. Bhatnagar, Director Scientific & Industrial Research had gone to U.K. and U.S.A. for a study tour of the scientific and industrial laboratories in these countries. On the formation of the Physical & Chemical Sections of the Council of Scientific & Industrial Research in 1944 Dr. S. Parthasarathy was designated as Assistant Director of Scientific & Industrial Research.

Dr. S. Parthasarathy was the Representative of the Govt. of India on the British Mission which was sent to Japan in 1945 to report on the physical effects of the atom bomb at Hiroshima and Nagasaki. He was selected by Sir A. Ramaswamy Mudaliar, the then Industries Member of the Viceroy's Executive Council and was given an honorary rank in Air Force to proceed to Japan which was under military occupation at that time. The report on the Mission's visit was issued by his Majesty's Government in Great Britain in 1946 as a White Paper in a summarised form. Dr. S. Parthasarathy submitted a separate report to the Government of India in 1946.

In 1947 Dr. S. Parthasarathy was sent as Officer on Special Duty incharge of the Building Research Unit, Roorkee (U.P.) for about six months. During this period he sent a plan for a full-fledged Building Research Station in India in addition to having initiated and guided research in the Unit.

On the formation of the National Physical Laboratory at New Delhi under the Council of Scientific & Industrial Research in 1947 he came back to active research work in ultrasonics and was appointed Assistant Director Incharge Division of Sound, a position he held till 25 Nov. 1959 when he was promoted to the position of Deputy Director, National Physical Laboratory. In June 1961 after the sudden demise of Sir K.S. Krishnan, Director NPL, he was appointed Deputy Director Incharge National Physical Laboratory, a position which he held till January 16, 1962 when he expired due to his constant ill health.

#### HONOURS AND AWARDS AND MEMBERSHIP OF LEARNED SOCIETIES

Dr. S. Parthasarathy was a distinguished personality in his life time. He had earned many honours and awards in his life on the distinguished performance and work done by him. The various honours and awards can be enumerated as follows :—

He was elected a Fellow of the Royal Institute of Science, Bombay soon after his passing B.Sc. from Bombay University.

He was awarded the Moos Medal, the highest distinction in Science from Bombay University on the award of his D.Sc. by the University of Bombay.

His name has been engraved on the Roll of Honour of the Royal Institute of Science, Bombay University, Bombay.

He was awarded a personal Fellowship at the Nobel Institute of the Royal Academy of Science, Stockholm in 1939 which he received in person at the Nobel Institute, Stockholm in February 1940.

He was elected a Fellow of the Institute of Physics of Great Britain in 1939.

He was elected a Fellow of the Royal Institute of Chemistry of Great Britain and Ireland in 1939. It was a rare distinction bestowed on Dr. S. Parthasarathy to be the Fellow of both the Royal Institutes of Physics and Chemistry.

He was the Representative of the Government of India on the British Mission sent to Japan in 1945 to report on the physical damage done by the atom bomb explosions at Hiroshima and Nagasaki.

He was elected a Fellow of the National Institute of Sciences of India which he later on resigned.

He attended the UNESCO General Conference (VII Session) held at Paris in 1952 as a delegate of the Government of India.

He attended in 1954 at New York (USA) the Silver Jubilee Celebrations of the Acoustical Society of America by special invitation where he also delivered a commemorative lecture.

In June 1954 he presided over a panel at the Symposium on Ultrasonics held at Providence, Rhode Island USA, under the auspices of the United States National Science Foundation.

In May 1955 he attended by Invitation the International Congress on Ultrasonics held at Marseilles Italy and delivered an Invited Talk.

In July 1957 he attended by Invitation the International Colloquium on "Optical and Acoustic Properties of Compressed Fluids and Intermolecular Effects" held at Bellevue France and delivered an Invited Talk.

In 1960 he presided over the Physics Section of the 47th Indian Science Congress Session held at Bombay and delivered the Presidential Address.

## SCIENTIFIC CONTRIBUTIONS

Dr. Parthasarathy's research work has covered an extensive field in Physics such as classical Scattering of Light, Raman Effect, X-ray Diffraction, Physics of Corrosion

and Ultrasonics. His work had been always important and stimulating and had formed the basis of further work for him and many others in the field. In the field of ultrasonics his contribution had been extensive and he was considered to be an authority on the subject. He had opened the subject of Thermosonics, a new field in Ultrasonics related to sound and heat. His work has been widely referred in books, reports, journals and other publications in Ultrasonics of his times. He had published 142 papers on the various subjects. His work had been unique since he had command and excellence both in physics and chemistry.

Broadly speaking Dr. S. Parthasarathy's work can be considered under the following heads :

- (i) Scattering of Light & X-ray Diffraction
- (ii) Industrial Investigations
- (iii) Ultrasonics

The work on Light Scattering and X-ray Diffraction has been carried out in the first phase of his research career on which he was also awarded D.Sc. This work was carried out at the Indian Association for the Cultivation of Science, Calcutta. The work on industrial investigations was carried out during the period of his association with the Board of Scientific & Industrial Research as technical secretary. The work on ultrasonics was started by him in 1935 at the Indian Institute of Science, Bangalore with Sir C.V. Raman. This work engrossed and stimulated him so much that he carried it out throughout his research career and became a major field of his activity on which he later became a world authority. A brief but comprehensive account of his contributions in these fields can be reported as follows :

(i) *Scattering of Light & X-ray Diffraction*

In the field of classical scattering of light Dr. S. Parthasarathy established a correlation between the depolarisation factor and chemical constitution after critically examining the scattering of light by gases and vapours. Dr. S. Parthasarathy also propounded a molecular theory of the scattering of light by binary liquid mixtures taking account of both optical anisotropy of the molecules as well as the anisotropy of the Lorentz polarisation field which effectively diminishes the molecular optical anisotropy. He verified this theory through experimental studies of 25 binary liquid mixtures and discussed the results in the light of magnetic and electric birefringence of binary liquid mixtures.

Following some anomalous results on light scattering in binary liquid mixtures, colloids and optical glasses, Dr. S. Parthasarathy further showed that scattering even in such cases was purely molecular and not due to clusters, if any, at the critical solution temperature and therefore no new theory was necessary to explain the

supposed anomaly. He further showed that optical strain in optical glasses had nothing to do with the anomalous results.

Dr. S. Parthasarathy also studied Raman Spectrum of formic acid, correlated the Raman frequencies with the structure of formic acid and showed the successful employment of Raman Effect in the study of the progress of chemical reactions.

Dr. S. Parthasarathy studied X-ray diffraction in liquid mixtures to test the view of the cybotactic state of liquid and found evidence for the same in his results.

### (ii) *Industrial Investigations*

A number of projects of the industrial nature had been carried out by Dr. S. Parthasarathy to a successful finish. These projects were the following :

- (a) Recovery of titanium dioxide from bauxite sludge, details of a pilot plant were given after complete laboratory investigation.
- (b) Manufacture of soluble barium salts from barytes, details of the process were given.
- (c) Electrical properties of a large number of specimens of mica obtained from various mines in the country were investigated.
- (d) Ammonium phosphate from phosphatic nodules, a process for obtaining was worked out.
- (e) Investigations on winning magnesium from magnesite were carried out.
- (f) Investigations were also made on luminous paints and camouflage paints for infra-red.

### (iii) *Contributions in Ultrasonics*

Dr. S. Parthasarathy's main researches had been in the field of ultrasonics. He had carried out a systematic study of absorption and velocity in a number of liquids at many ultrasonic frequencies. He was initiated to this work at the Indian Institute of Science, Bangalore by Sir C.V. Raman in 1935. His outstanding contribution at that time was to measure ultrasonic velocity in liquids using diffraction of light by ultra sound. His latest work on the equivalence of sonic and thermal energies had opened up a new chapter in the subject under the name of Thermosonics. He had shown how in the conversion of sonic energy to heat, the law of conservation of energy is observed and the factor of proportionality in the conversion is  $4.19 \times 10^7$  erg/cal., the same as that of J, the mechanical equivalent of heat. The above relation is expressed by  $I = JH$  (where I is the initial intensity of sound and H is the heat produced). This observation was applied in evolving a new method for determining  $\alpha$ , the absorption coefficient of ultrasonic waves in liquids applicable at all frequencies.

Equally important is the observation made by him that at low frequencies (400 kHz) the ratio  $I/\omega v^{-2}$  has a constant value (the electrical units remaining the same) for all liquids. This had enabled him to determine the absorption coefficient in a large number of liquids in a region where such measurement had been almost impossible before the development of this new technique. These results have led to the important observation that at low frequencies, the absorption of sound is classical though at higher frequencies such absorption is anomalous.

Studies of far-reaching importance were also carried out in the field of sound absorption in liquids in relation to their physical properties particularly the specific heats and their ratio. It was observed that there was a close relationship between  $\gamma$ , the ratio of specific heats and sound absorption and a new formula connecting the two had been established. Anomalous absorption of sound had thus been solved for the first time and the solution explained observed values in all cases. It had been shown that liquids having high value for the ratio of specific heats are also those which show highly anomalous sound absorption. This solution also explained variation of sound absorption in liquids with temperature and pressure. It had also been shown that the change of sound absorption in a series from liquid to liquid followed the change in the value of ratio of specific heats.

It had been observed that the phenomenon of sound absorption and light scattering are connected. The analysis showed that the intensities of the Brillouin reflections in light scattering are a function of the sound absorption coefficient. This observation explained the weak intensity of Brillouin reflections in the case of highly viscous liquids which fact could not be accounted for on the basis of Landau-Placzek theory. The work had also brought out clearly that  $\gamma$ , the ratio of the specific heats is an important physical property of the liquid state just like viscosity, density, boiling point, etc. The ratio of the specific heats also plays a prominent role in phenomena like light scattering and sound absorption. From an examination of  $\gamma$ , viscosity, observed sound absorption and the ratio observed to classical absorption in several series of liquids, an independent evidence had been obtained that it is the dominant factor in sound absorption. Further Several rules relating sound absorption to chemical constitution were obtained as a result of these studies.

As a result of a large number of measurements of sound velocity in organic liquids, he has further derived a number of relationships between sound velocity and chemical constitution. It has also been found that sound velocity and molecular weight bear definite relationship among themselves in homologous series enabling one to calculate the sound velocity of any compound of a series. Another relation uncovered by him between sound velocity and viscosity of organic compounds is given by the expression

$$v^{1/3}/\rho = A + B/\sqrt{\eta}$$

where A & B are constants,  $\rho$  is density,  $v$  is sound velocity and  $\eta$  is liquid viscosity. A large number of papers followed after this work done by Dr. S. Parthasarathy, notably those of Schoff and Rao on interlinking velocity with constitution.

In the matter of diffraction of light by ultrasonic waves in liquids, he had obtained experimentally the first, second and third order reflections successively at the respective Bragg angles, provided the sound wavelength is very small and the sound intensity is fairly high. For larger sound wavelengths, however, the Raman-Nath theory is followed.

Dr. S. Parthasarathy has made notable studies of the piezo-electrically oscillating quartz crystals. He showed that piezo-electric crystals could oscillate not only in the thickness mode at its fundamental frequency but also transversely and at other harmonics not observed before such as even multiples and half of odd multiples of its fundamental frequencies. The effect of the superincumbent column in contact with a vibrating quartz plate was also worked out theoretically wherein the effective damping and the shift of resonant frequency were calculated. It was also shown by optical diffraction pattern studies that quartz crystals can be made to sustain vibrations at two frequencies applied simultaneously. A study of the relationship between Q of a quartz crystal and viscosity of the liquid has also been made and it has been found that a relationship of the nature  $Q \cdot \eta z = C$  exists between the two parameters where K and C are constants. This relationship is useful in the determination of viscosity of an organic compound.

The ultrasonic output from quartz crystals oscillating in several organic liquids at several frequencies had also been measured experimentally using thermal method. The heating of the liquid is due partly to absorption of ultrasound and partly due to the heating up of the dielectric. It was found that the efficiency of the quartz crystal as a transducer was dependent on the absorption coefficient of the liquid in which it oscillated and greater efficiency was obtainable in liquids of low absorption coefficient. However the ultrasound output decreased with decreasing absorption coefficient. This was true even when the crystal oscillated in its 3rd and higher harmonics. The maximum conversion efficiencies occurred at frequencies of the order of 3 to 5 MHz in high absorbing liquids and as the frequency increased to 10 MHz or more, the efficiency dropped to very low values.

Thus, to sum up, it can be said that Dr. S. Parthasarathy was a senior physicist of the country who combined in himself an extensive knowledge in various branches of physics with intensive specialisation in the field of ultrasonics.

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There he wrote the '*Flora of Lahore*' which is still consulted by the students of botany in Punjab on both sides of the border.

#### *UP Assignments*

In 1931 he joined as Assistant Professor in Banaras Hindu University and later became Professor. On his return from England in 1934 after the probationary period for the Indian Civil Service, the author too was assigned to Uttar Pradesh. In 1936, when he was posted as Assistant Collector at Faizabad they renewed their friendship. Joshi was a frequent visitor to Faizabad, Allahabad, Almora and Rae Bareli, places where he was posted. As the author was collecting and studying algae from the ponds and fresh-water streams of these districts, he had to rely on his own resources for research. He built a modest laboratory in his home and Joshi kept him up-to-date with recent developments in research by providing him reprints of papers as well as references.

At Banaras, Joshi developed an active school of research on anatomy of Angiosperms. He got his DSc in 1937. He was author of about 100 research papers in the various fields of botany, such as anatomy, embryology, morphology, cytology and systematic botany, which were published in leading botanical journals of India, the UK, and the USA. Not only was he an indefatigable research worker himself but also provided inspiration to his students a number of whom got PhDs under him.

#### *Assignments in Punjab*

Somehow, we always happened to keep together in our assignments. In 1945 when the author came to Delhi as Secretary of the Imperial Council of Agricultural Research, Joshi joined as an editor of the Dictionary of Economic Products under the Council of Scientific and Industrial Research. In the same year he was selected as Professor of Botany of Government College and Director of the Punjab University Botanical Laboratory, Lahore, where he continued till the partition of 1947 drove him to Delhi along with his family. At that time the author happened to be the Deputy Commissioner of Delhi, and Joshi and his family members along with numerous other refugees were living with him.

Punjab was in confusion and educational institutions were dispersed in a number of towns. The new Botanical Laboratory was located at Government College, Hoshiarpur where Joshi joined as Professor of Botany at the close of 1947. Professor Joshi continued in Hoshiarpur till 1951. In that year he was appointed Principal of the Government Training College for Teacher at Jullundur. In 1953 he joined as Director of Public Instruction and Secretary to the Punjab Government and continued in that capacity till 1957.

*Father of Punjab University*

In 1957 he got the greatest opportunity of his life when he was appointed as Vice-Chancellor of Punjab University. With single-minded determination and great sense of dedication he started building up the new campus of the university. Mr P Jeanneret was the Chief Architect of the campus and was assisted by BP Mathur, Senior Architect. Both these persons worked in close collaboration with Joshi who examined all the building plans in great detail and gave many helpful suggestions. The result of this collaboration was the beautiful campus of the University at Chandigarh which has won admiration of educationists from all over the world. If any person can validly claim to be the father of this University, it is AC Joshi.

On February 1, 1960, on account of excessive work he developed a heart ailment. However, he methodically mastered this handicap and adjusted his diet and work in such a manner that he continued active work in the field of education.

Dr. Joshi was internationally known as an educationist and he travelled widely in Europe and the USA and also visited Mexico and South America.

*At Planning Commission, Delhi*

He left Punjab University in June 1965, and joined as Adviser for Education in the Planning Commission in July 1965 where he continued till August 1967. This was a highly creative period for him and his advice was eagerly sought by scientists and educationists. He made a keen and intimate study of the educational problems of the country and his ideas and suggestions made an impact on the development of education and science.

*Banaras Strain*

In September 1967 he very unwisely accepted the Vice-Chancellorship of Banaras Hindu University. This was an unfortunate choice for him for on account of his heart ailment he was exposed to great strain and there is little doubt that it shortened his valuable life. However, he heroically continued to grapple with the problems of this difficult university till September 1969 and showed great moral courage in curbing student indiscipline in a place where it had become endemic.

In hours of hard work and crisis, his wife Mrs Sumitra Joshi was a great source of help and inspiration to him. His son, Arun Joshi is the Executive Director, Sri Ram Centre for Industrial and Human Relations. He is the youngest novelist of India and has won many awards for his literary work. His advice as a business administrator is greatly sought by many institutions. His talented daughters Saroj and Shashi, loved him dearly. His happy family life contributed in no small measure to his success as an administrator and scholar.

### ASSOCIATION WITH LEARNED BODIES

Dr. Joshi was a member of Administrative Board and Central Advisory Board of Education of National Council of Education Research and Training, Advisory Board ICAR; Council of Commonwealth Universities Association; Fellow and Member Executive Council, (later Vice-President in 1963) National Institute of Sciences of India; Honorary member Asiatic Society of Bengal; Member, Govt. of India Committee for Location of High Altitude Research Laboratories; President (Botany Section in 1946) and General President of Indian Science Congress Association (in 1969); Chairman, Science Committee, World Confederation of the Organizations of Teaching Profession at Washington (1964-66); President, North Indian Science Association. He was master and founder planner of the Panjab University campus. He appointed talented and meritorious staff and had a plan to build the university as International University.

He was a keen researcher and Botanist of repute nationally and internationally and had published more than 100 original research papers in Journals of repute in India and abroad. He had guided several Ph.D. scholars and was member of board of Editors of leading Botanical Journals in India. He had widely travelled in Europe, USA, Mexico, South America, Canada, Australia and Japan. He was internationally known as Educationist and a Scientist and was planning to have his own institute of Education.

### LAST DAYS

Since his retirement from Banaras University he lived in his home in Chandigarh. His advice was eagerly sought by Vice-Chancellor Bishan Singh Samundri for the development of Guru Nanak Dev University at Amritsar which he frequently visited. In fact, he had gone on an advisory visit to Amritsar on Sunday, February 14, 1971 when on returning, greatly exhausted, he expired at 8 p.m. He was cremated on February 15, 1971. Among those who attended his funeral were the staff and students of Punjab University, Judges of the Punjab and Haryana High Court, Directors of Public Institutions of Punjab and Haryana, Principals of the local colleges and the Director and a few Doctors of the Post-Graduate Institute of Medical Education and Research. The wreaths were placed on the body of Dr. Joshi by the Governor of Punjab, Dr. D.C. Pavate, Dr. Tulsi Das and Dr. Santokh Singh, former Directors of the PGI, Mr. H.R. Bhatia, former Chairman of the Punjab State Electricity Board, Mr. Bishan Singh Samundri, Vice-Chancellor of Guru Nanak Dev University, Mr. Amrik Singh, Registrar of Punjabi University, Dr. P.S. Gill, Director of the Central Scientific Instruments Organisation, Dr. P.N. Chutani, Director of the Post-Graduate Institute of Medical Education and Research, Mr. V.S. Mathur, Mrs. G. Parampal Singh, Director of Public

Instruction, Punjab, Mrs. H.M. Dhillon, DPI, Chandigarh, Mr. P.L. Verma, former Chief Engineer of Punjab, Principal O.P. Sharma, and Principals of various colleges and Mr. K.L. Malhotra, Secretary to the Vice-Chancellor of Punjab University.

"Dr. A.C. Joshi is now dead but not gone. He will live for ever in the hearts of practising school science teachers in the country, and of countless others. Like Prof. Armstrong in Britain in the beginning of this century, he alerted the nation regarding our backwardness in school science education. It is not widely known that he began to advocate new ferment in science education even before the Russian sputnik had gone into space. He gave a respectable status to the science teachers by organising the All-India Science Teachers' Association in 1956.

"He saw their problems clearly and initiated the Science Club Movement in the country on a large scale. He discovered talent where he could find it in the country. Even in his retirement, he was in search of young people who could contribute voluntarily to science education. In qualitative set up, he rejected firmly the hierarchical principle of excellence. About four days back, he rang me up to come to his place in connection with the writing of a book. Much to my discomfiture, he talked passionately, while standing on his legs for about two hours, of the unfinished business in science education. He was deeply involved in the problems of a Science Community Centre at Chandigarh, recognition of the critical role of science teachers in developing experimental curricula, strengthening the voice of science teachers by a forum like the Vigyan Shikshak, personnel of the State Institutes of Science Education in the country and research in science education. He was snatched away too soon. The National Science Teachers' Association feels orphaned."

He belonged to that generation of Indians—a generation that is perhaps, quickly disappearing—that took up work for the sake of work itself and performed it with the most rigorous commitment. It was because of this, more than anything else, that he took up assignments that promised no visible rewards.

He was the most giving of teachers and a most loyal friend. His friendships extended not to a restricted class—academic or social—but over a spectrum that ranged over all walks of life. More than most, he would be missed by those hundreds of young men who were at one time or another associated with him; as students, on botanical expeditions, as members of the faculty and those numerous others who cannot thus be classified and who were attracted to him by his gentleness.

In an age characterized increasingly by opportunism he carried his life by those uncompromisable values that have characterized the best of Indian civilisation down ages,

Dr. Joshi deserved the highest honour which his country could confer as a renowned botanist and educationist and as builder of the most modern university

campus, Punjab University, Chandigarh. However, with all the qualities he possessed, he had too much integrity of thought and action to kow-tow to politicians. and thus he had no place in the rat race. He was always cool and calm and never allowed his judgement to be coloured by passions of politics and religion. He was fair-minded and had a sense of justice. That is why he managed to select highly talented people for the professorships which he created. He will be long remembered by his friends and students as a great Indian and a great son of Punjab. His memory should be perpetuated by building a suitable memorial in his honour in Punjab University, Chandigarh, which he built up from scratch, and also in Guru Nanak Dev University whose development he fostered by his mature advice.

## MS RANDHAWA

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A. K. Rose

## NALINI KANTO BOSE

(1901-1972)

Elected Fellow 1938

### BIRTH, PARENTAGE & CHILDHOOD

DR. NALINI KANTO BOSE, an eminent scientist, founder Director of River Research Institute, Government of West Bengal was born on 23rd March, 1896 at Mymensingh district now in Bangladesh. He traced his lineage from a reputed Brahmo family of Vikrampore, Dacca, now the capital of Bangladesh. He was the second amongst the five sons of Late Harakanto Bose, reputed Headmaster of Hare School at Calcutta. Of five brothers, the eldest Late Amiya Kanto Bose, was a renowned Barrister of Calcutta High Court and a Member of the Parliament. The third brother Dr. Nabani Kanto Bose, is a Medical Practitioner in Delhi. The fourth brother, Late Dr. J.K. Bose, was a fellow of National Academy and the Director of Soil Sciences, Government of India, while the youngest brother, Prafulla Kanto Bose, was a Station Engineer at All India Radio, New Delhi.

Late Harakanto Bose, father of Dr. N.K. Bose served in the Education Department of undivided Bengal. He became the Headmaster of two premier High Schools of undivided Bengal. (i) 1910-15 Raja Peary Mohan Mukherjee School, Uttarpara, Dist. Hooghly. This school had the distinction of training a number of distinguished students who had made great success in the various lines of activities in Bengal, (ii) 1916-24 Hare School, the topmost High School in undivided Bengal that had the credit of turning out many eminent students who occupied the top most positions in the different lines of activities in whole of India, such as, Supreme Court Judges, High Court Judges, eminent educationists and jurists such as Sri B.L. Mitter and other successful students who had made their marks in Indian Civil Services and business activities. He retired from Govt. service in 1924 and devoted the rest of his life in the service of the religious society—All India Sadharan Brahmo Samaj as a Secretary and in other Social works.

His mother, Late Kusum Kumari Bose, was a devout lady, who brought up her five sons in the best tradition of Brahmo Culture. As was customary in those days, she was married young but taught herself with the help of her husband the best teachings of different Indian Culture. She died young. Dr. Bose's maternal uncle, Late Charu Chandra Guha, was a great linguist and author of voluminous Anglo-

Bengali Dictionary published from Dacca in 1916. It was a monumental work in those early days and is regarded as one of the best books of reference till to-day.

Dr. Bose led a very simple and honest life since his childhood. His father taught him to be a strict disciplinarian and follow the path of honesty and truth. His early education started under the guidance of his mother who took great pains in teaching him the rudiments of language and arithmetic. He was admitted to a Primary School when he was barely eight years old. His father used to supervise his studies scrupulously. When he was barely sixteen years old he was ready to appear at the Matriculation Examination but being short of sixteen years by two months and a half he had to wait for another year.

### **FORMATIVE INFLUENCES ON THE YOUNG SCIENTIST**

A spirit of self-reliance, self-discipline and self-control, and a sense of honesty and truthfulness developed into the young scientist under the strict guidance of his Headmaster father. Dr. N.K. Bose was admitted in the Presidency College, Calcutta in 1913. He had the honour of studying under the guidance of Prof. P.C. Roy, of whom he was a very favourite student. During his Post-graduate studies (1917-1919) he was highly influenced by Prof. S.N. Bose, F.R.S. and Prof. N.R. Sen, F.N.A. of Department of Applied Mathematics, Calcutta University. This young scientist in his life was also influenced by Prof. Prandtl, the originator of "Tragflugel Theory" in the University of Gottingen, Germany.

### **SCHOOL AND UNIVERSITY EDUCATION**

*Matriculation* : From the begining, Dr. N.K. Bose, had a brilliant academic career. He stood fourth in the Matriculation Examination of the Calcutta University in 1913 from Uttarpura Government School and secured a First Grade Scholarship. He stood first in English in the same examination among the successful candidates of the Burdwan Presidency Division and secured a Gold Medal and a cash prize of Rs. 200/-.

*I.Sc. (1913-15)* : Calcutta University from Presidency College, Calcutta. He stood eleventh among the successful candidates and secured a Merit Scholarship. He was fortunate in being a student of Acharya P.C. Roy in the Intermediate classes and was greatly influenced by him in later years. Netaji Subhas Chandra Bose was one of his classmates.

*B.Sc. (1915-17)* : Presidency College, with Honours in Mathematics, and Physics and Chemistry as subsidiary subjects. He stood second among the First Class candidates.

*M.Sc. (1917-19)* : University College of Science, Calcutta, in Applied Mathematics. He stood second among the First Class candidates and secured a Silver Medal. He had the great privilege of studying under Prof. S.N. Bose, F.R.S. and Prof. N.R. Sen, F.N.A.

*Ph. D.* He obtained Ph.D. degree from Gottingen University, Germany in 1923 on his thesis in Aerodynamics within an exceptionally short time of one year.

*F.N.I. :* He was made a Fellow of the National Institute of Sciences of India (F.N.I.) in 1938 on recommendations of Prof. M.N. Saha for his significant contribution in Hydrology and Fluid Dynamics.

*Fields of Specialisation :* He specialised in the fields of Aerodynamics, Hydraulics and design of structures built on permeable foundation.

### PROFESSIONAL CAREER, CONTRIBUTION TO NEW KNOWLEDGE

After securing M.Sc. degree he joined the University of Dacca as Lecturer and worked there for one year (1920-21). In 1922 he left for Germany for higher studies. There he worked under the guidance of Prof. Prandtl and secured his Ph.D. from the University of Gottingen, Germany in 1923; thereafter he joined the University of Aligarh as Reader of Mathematics and continued there for two years. During that period he was awarded the Griffith Prize of Calcutta University for his outstanding thesis on Aeroplane Movement based on Tragflugel theory. In 1927 he joined Punjab Irrigation Department as Mathematical Officer in the Irrigation Research Institute, Lahore.

He initiated the study of the problem of water-logging in Punjab under the Directorship of B.G. Wilsdon. Immediately after joining Punjab Research Institute he was deputed by Govt. of India to visit Hungary to study the Torsion Balance under Prof. Eotvos in Budapest. While in Hungary he made an extensive tour with the survey party of Prof. Eotvos and later learnt all the techniques of manipulating the balance and interpreting the survey data. When he returned to India he purchased a Torsion Balance from Hungary for Punjab Govt. for use in Punjab. On returning to Punjab Research Institute he engaged himself in : (i) setting up the Irrigation Research Institute specially its hydraulic Laboratory, (ii) survey of the water-logged areas of the Punjab specially about the location, extent and connection with the irrigation system of Punjab; depth and distribution of underground water table and their connection with the distribution of rock formations. These extensive and prolonged studies later on came as a publication of Punjab Govt. and helped in locating different areas where extensive anti-water-logging measures were undertaken with success. While studying the movement of underground water problems of seepage from canals he wrote a paper on design of weirs on permeable foundation in collaboration with Dr. A.N. Khosla, the then C.E. of Punjab Irrigation Department. This publication of Central Board of Irrigation & Power, Delhi, is now recognised as a fundamental publication on the subject and the best book of reference for design of structures on permeable foundations. He made an elaborate study on regime flow in canals and rivers and contributed a series of papers on these studies. In 1932

he went to Gottingen again and worked with Prof Prandtl on various aspects of fluid theory. He inspected different hydraulic laboratories of France and England when he had the opportunity of meeting Prof. Karl Terzaghi in Vienna. In 1942-43 at the initiative of Prof. M.N. Saha and Sri S.C. Majumdar, a renowned Engineer of the Irrigation Department, the services of Dr. N.K. Bose were lent by the Govt. of Punjab to the Govt. of Bengal as the Director of River Research Institute. He designed the Institute and set it up at Haringhata near the Agricultural Research Station, West Bengal. He continued as the Director of this Institute till 1956. After retirement from the Institute, he joined as Special Officer to work out the details and plans of the Ganga Barrage Project in collaboration with various international teams of experts from world organisations like U.N.O., World Bank and others. The experts included Prof. Einstein from California University, Berkly, U.S.A., Port. Ippen from M.I.T., U.S.A., Prof. Hensen, U.N. Advisor for the Port of Calcutta. While working on the above projects, he joined as the Advisor to the Irrigation Minister, West Bengal. He was simultaneously appointed as Professor in the Indian Statistical Institute, Calcutta, where he worked till 1967. He was closely associated with North Salt Lake Reclamation Scheme of the Government of West Bengal. At the instance of Dr. B.C. Roy, Chief Minister, a party of Dutch Engineers was invited to Calcutta, who inspected the Salt Lake area and prepared a feasible plan for reclamation of Salt Lake area. He also studied the water potentials of the Damodar, Ajoy and Hooghly rivers for water facility to greater Calcutta. In December, 1962 Dr. Bose led the Government of India delegation that was constituted to accompany and explain to the members of the ECAFE mission, who came to visit Sundarbans and study its various problems of flood control, agricultural economy and population distribution.

I. R. PRAMANIK

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## **KUVERJI GOSAIJI NAIK**

**(1885-1974)**

**Foundation Fellow 1935**

### **BIRTH, PARENTAGE & CHILDHOOD**

**KUVERJI GOSAIJI NAIK** was born on August 1, 1885 at Katargam, Surat District in Gujarat State. He was the elder son of Shri Gosaiji Bhagwanji Naik and Jamanaben Naik. His father was Anavil brahmin and was farmer by profession. He was also influenced by his uncle Shri Nicchabhai Naik in his young age. His younger brother, Shri Manibhai Naik was practicing as a doctor in Katargam village. He had his primary education in the village of Katargam.

### **SCHOOL AND UNIVERSITY EDUCATION**

He studied in I.P. Mission School, Surat for his secondary education. He used to walk from Katargam to Surat for attending the school. This he had to do because of poor financial condition of his father. Even under these circumstances, he worked hard for his studies and stood within first ten in the Matriculation examination of University of Bombay. He passed this examination in the year 1901.

Inspite of adverse financial conditions, he joined Wilson College, Bombay for further studies. He could do this only because he was admitted to Gokuldas Tejpal Boarding House with nominal fees. Here he established his brilliant career. He passed B.A. examination of University of Bombay in first class in the year 1905 and stood first in science subjects. He was awarded 'Narayan Vasudev Science Scholarship' and also the 'University Daxina Fellowship'. He passed B.Sc. examination of the same University in the year 1907, standing first in University of Bombay with Geology and Chemistry. He passed M.A. degree examination in 1908 in first class taking Chemistry, History and Sanskrit as his subjects. Thus he acquired a broad based education rather than narrow specialisation in one subject only.

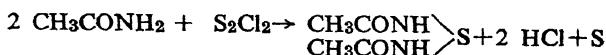
### **TEACHING CAREER AND RESEARCH**

He joined Wilson College, Bombay as a lecturer in the year 1908 and taught Chemistry, Geology and Indian History. After a lapse of time, he joined Krishinath College, Berhampur (West Bengal) as Professor of Chemistry. The college was affiliated to Calcutta University. Late Sir Ashutosh Mukherjee, then Vice-Chancellor

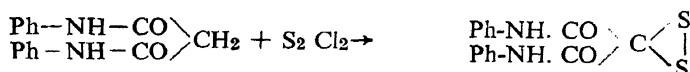
of Calcutta University visited the college and he was impressed by the knowledge and teaching of Dr. Naik and invited him to join as Junior Professor of Chemistry at College of Science and Technology. Here he came in touch with the great scientist, Sir P.C. Ray who inculcated the spirit of research in him. This became the turning point in the life of Dr. Naik. He then moved to Baroda college as Professor of Chemistry. In the year 1919, he became recipient of Sir Mangaldas Nathubhai Fellowship and went to London to carry out research under supervision of Professor J.F. Thorpe at Imperial College of Science and Technology. Here he worked independently for two years and submitted a thesis entitled, "The interaction of sulphur monochloride with substances containing Reactive Methylene Group or Substituted Methylene Group." He was awarded the coveted D.Sc. degree of London University in the year 1921 on this thesis. He also gave an admirable account of research work done by him in Applied Chemistry for the advancement of "The Gold and Silver thread Industry of India" before a special meeting of Fellows of Royal Institute of Chemistry (London), which decided to elect him as a Fellow of Royal Institute of Chemistry" (F.R.I.C.), in 1921. He returned to India after working in the Research Laboratories of Badischa Anilin Soda Factory A.G. in Germany. On his return from England, he joined Baroda College as Professor of Chemistry and Head, Chemistry Department. He was also holding the charge of Industrial Chemist to Government of Baroda from 1924. Later he became the Principal of Baroda College and retired from the Baroda Government service in the year 1944. He then joined Gajjar Laboratories at Bombay for a short period. He was invited by Late Shri Kasturbhai Lalbhai, President of Gujarat Education Society to join as Principal of L.D. Arts and M.G. Science Institute at Ahmedabad. He joined it in the year 1946 and continued till 1950. He then gave his services as Rector to newly founded Gujarat University from 1950 to 1952. After the expiry of the term as Rector, he joined as Principal at J and . Science College, Nadiad where he worked upto 1958. He joined as Principal of N.K.M. College of Science, Valsad in the same year and retired in the year 1969 at the ripe age of 84 years. Thus he served for the cause of education for more than sixty years.

### RESEARCH CONTRIBUTIONS

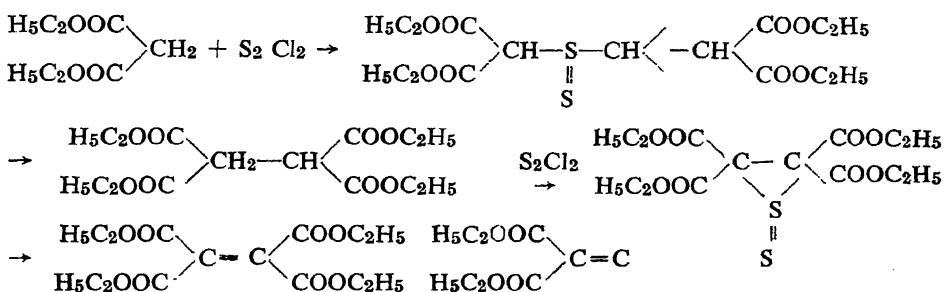
Dr. Naik's interest for research developed when he came in contact with late Sir P.C. Ray at Calcutta in the year 1917. This became the base for his research which he carried out at Imperial College of Science and Technology, London. He carried out research work independently on the interaction of sulphur monochloride with substances containing reactive methylene group. Amides like acetamide benzamide etc. gave monosulphides when reacted with sulphur monochloride.



but when above reaction is carried out with malonanilide, it gave disulphide, sulphur being linked to carbon of reactive methylene group.



This observation led to the investigation of reactivity of sulphur monochloride on substances containing reactive methylene group such as  $-\text{CO--CH}_2\text{--CO--}$ ,  $\text{NC--CH}_2\text{--CO--}$ , etc. Reactions of  $\text{S}_2\text{Cl}_2$  with malonic and cyanacetic ester and their mono sodium salt gave products which were devoid of sulphur and were found to have condensed systems, probably the reaction proceeded through the intermediate sulphide.



### RESEARCH WORK AT BARODA COLLEGE

After returning from England, he established a school of research at Baroda College. Here a detailed study of the Chemistry of reactive methylene group was carried out. It was at Baroda College that the study for M.Sc. degree by research was started by Dr. Naik in the year 1923. The Maharaja Sayajirao Gaikwad gave him the funds for the same. Many students obtained M.Sc. degree by research under his supervision on the above subject. Baroda College also became the first institution in University of Bombay for the study of the Ph.D. degree. At that time the jurisdiction of Bombay University was from Karanchi to Hyderabad. Dr. C.M. Mehta was the first Ph.D. from Baroda College in the year 1936. The above study of the reactive methylene group was extended to the action of sulphur dichloride, sulphuryl chloride, chlorosulphonic acid, thionyl chloride, selenium tetrachloride, iodine monochloride, selenium oxychloride, nitrosyl chloride etc. and different interesting compounds were obtained. The study of mercuration of reactive methylene compounds and coumarins using mercuric chloride, mercuric acetate and mercury acetamide was also carried out. A study of the reactivity of halogen derivatives of substituted amides of malonic acid with phenyl hydrazine. Atoxyl (sodium-p-aminophenyl arsonic acid), Grignard reagent and their reduction was also carried out in details. He established an international collaboration with Mme. Ramart-Lucas of University

of Sorbonne, Paris, France, for the study of Ultraviolet absorption spectra of amides of malonic acid, aceto acetic acid and cyanacetic acid. This was a unique collaboration existing in those days and a few joint research publications have come out from this collaboration. A study on the course of Pechmann condensation using allyl aceto-acetic ester was studied and the use of phosphorus oxychloride as a condensing agent for Pechmann reaction was also explored in collaboration with Dr. R.D. Desai.

### CONTRIBUTION TO INDUSTRY

Dr. Naik worked as an Industrial Chemist to the Government of Baroda from 1924 to 1944. He also contributed for the starting and development of Alembic Chemical Works at Baroda. He was deputed by the Government of Baroda to visit different industries in Europe and America in the year 1937 to get into the closer touch with industrial research being carried out in these countries. He visited I.G. Farben Industries, Baeyer and Co. etc. in Germany; Imperial Chemical Industries and 15 other industries in England. He visited many industries and universities in Moscow, Leningrad, Kharkov etc. in U.S.S.R. This was a secret visit and later on he wrote a book 'Russia as I saw it' in the year 1958. He visited Italy, Austria, France and Switzerland also. He went to America and visited many universities and Industries also. He gave lectures at twelve different universities in America. On the basis of this industrial tour, he delivered a popular lecture on, "At the Threshold of Industrialisation" before the Indian Science Congress Association on 4th January, 1939. He also delivered the 5th P.C. Ray lecture on 'Planning of Scientific Research for Industrialisation in National Reconstruction' on August 2, 1952 at Calcutta. These two lectures clearly reveal about the study which he made during the above visit and how industries in India can be started and put on firm basis.

### ACTIVITIES IN THE FIELD OF EDUCATION

Apart from being Principal of four different colleges in Gujarat, Dr. Naik worked on the important academic positions in university of Bombay and Gujarat University. He was elected as Fellow of University of Bombay in the year 1924 and held this position till 1950. He was member of the Board of Studies in Chemistry and also in Chemical Technology of Bombay University. He also worked as Dean, Faculty of Science, Member of Syndicate and Academic Council and played an important role in starting the University Department of Chemical Technology which is now considered as a premier Technological Institute in India. He also held similar academic positions in Gujarat University and played a leading role in establishing Ahmedabad Textile and Industrial Research Association (ATIRA) and L.M. College of Pharmacy at Ahmedabad. This was the first Pharmacy College in whole of Western India. He worked as a member and convener of Baroda University Commission where he played an important role in starting the M.S. University of Baroda.

## HONOURS

During this association with Baroda College, several honours were bestowed upon Dr. Naik. He was elected as Fellow of Royal Institute of Chemistry (London) in the year 1921. He was Founder Fellow of the Indian Chemical Society and later he became its Vice-President. He was also Foundation Fellow of Indian National Science Academy. He was elected as President of Chemistry Section, Indian Science Congress at Nagpur in the year 1931. He was also recipient of Sir P.C. Ray Medal in the year 1952.

## FAMILY

Dr. Naik was married to Shrimati Ichchagauri in the year 1908. They had a happy family life and were blessed with three daughters and one son. He was exponent of women education and so he encouraged his daughters to go for higher education, which was not prevalent in those days. His eldest daughter, Kamala has passed B.Sc. with Chemistry. Second daughter, Lila is B.A. and the youngest daughter, Tara is Ph.D. in Chemistry. While his son, Balvant is M.P.E., Springfield University, U.S.A.

## QUALITIES

Dr. Naik was a social reformer also. The system of dowry is highly prevalent in Anavil caste. In those days, he moved from village to village in South Gujarat and delivered lectures to remove the system of dowry. He was highly patriotic and was follower of Mahatma Gandhi. Eventhough he was Principal of Baroda College, he encouraged his daughters and other youths of Baroda college to take part in 'Quit India Movement' of 1942. He used his powers as Principal of Baroda College during this struggle and did not allow police to enter the campus of Baroda College. For this he had to suffer and he was not granted any extension in the service which he rightly deserved. He was a strict disciplinarian at college as well as at home. He was outspoken and use to call a spade a spade. He was fond of music and used to play harmonium. In later years of his life, he became philosophical in nature and continued to advice, inspire and help people till the end of his life. He died on 19th November, 1974. In his death, the country has lost one of its outstanding chemist, a powerful and an honest educationist and an able administrator.

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